



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

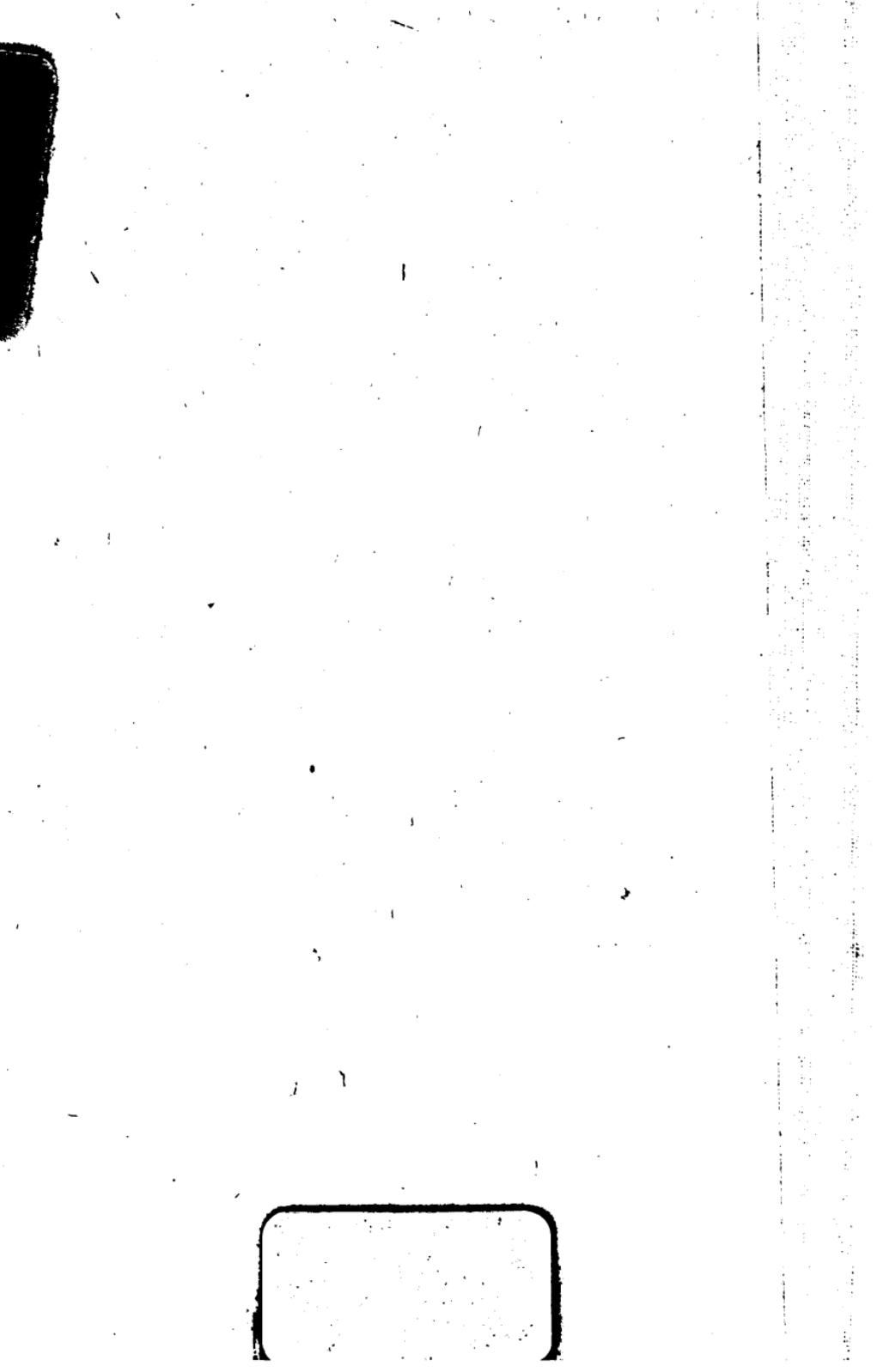
Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

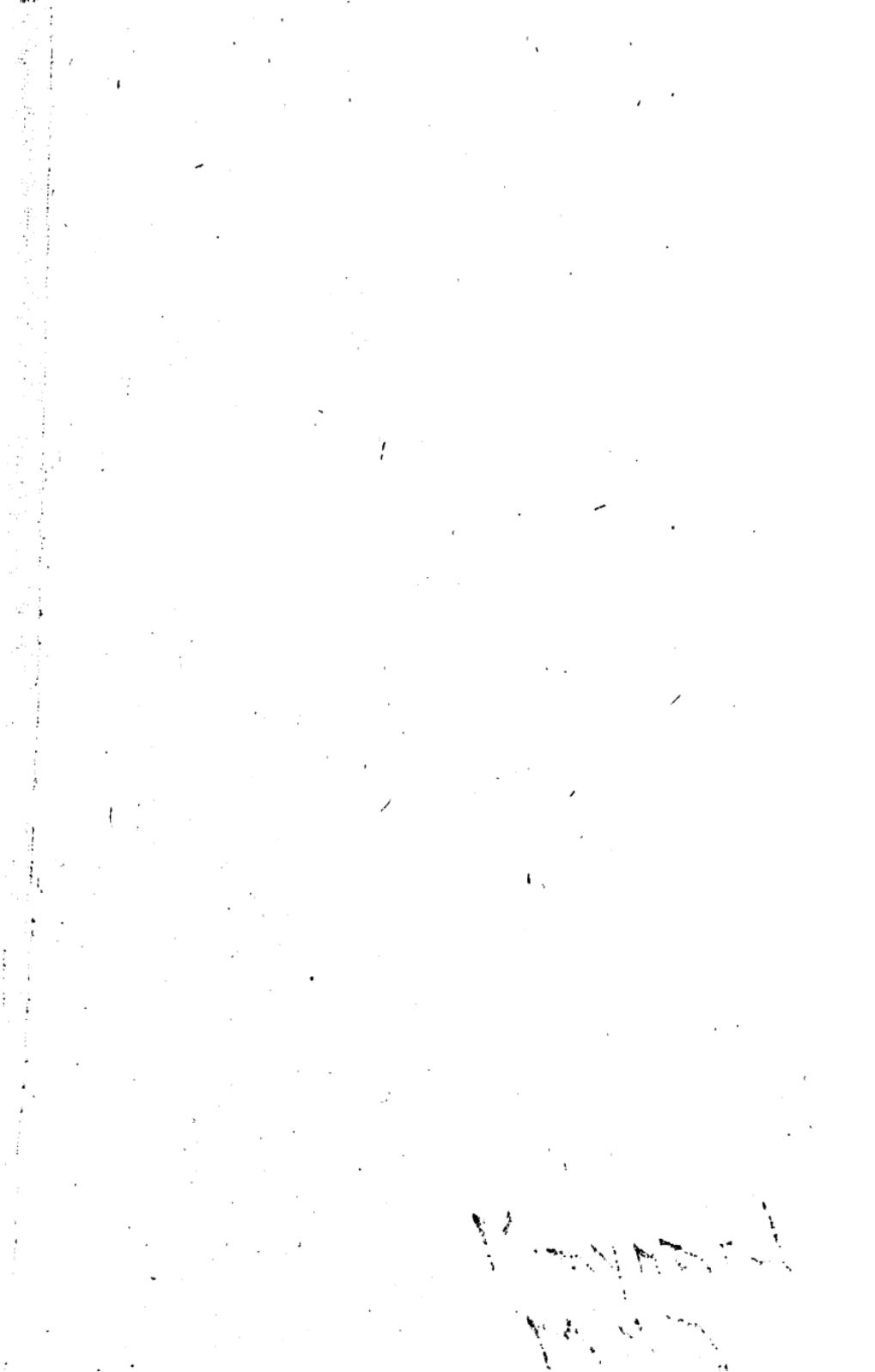
We also ask that you:

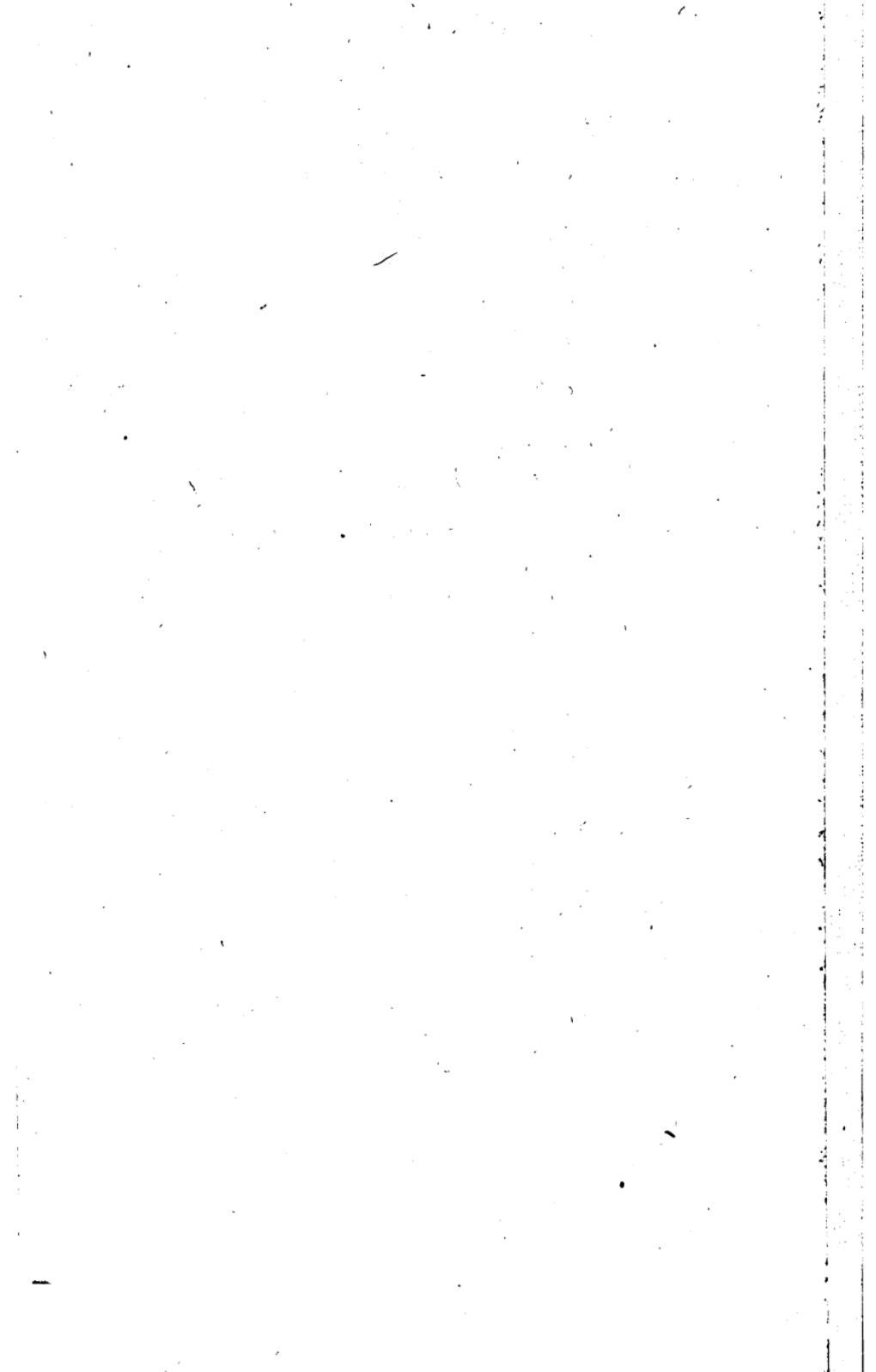
- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

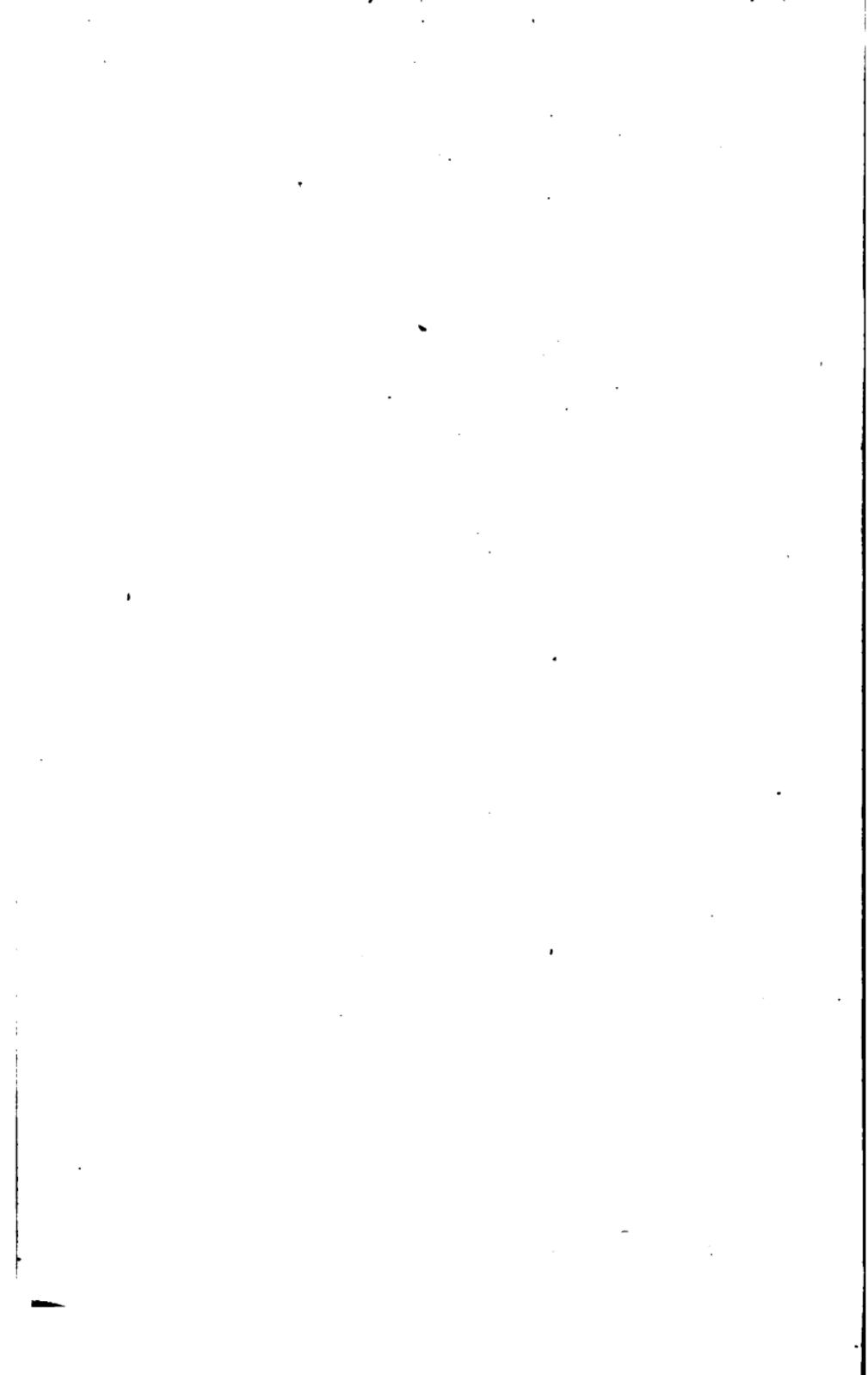
Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>











**THE NEW YORK
PUBLIC LIBRARY**

**ASTOR, LENOX AND
TILDEN FOUNDATIONS.**



A COTTAGE HOME.

LANDSCAPE GARDENING

AS APPLIED TO

HOME DECORATION.

BY

SAMUEL T. MAYNARD,

Professor of Botany and Horticulture at the Massachusetts Agricultural College, "Botanist to the Massachusetts State Board of Agriculture," Secretary of the Massachusetts Fruit-growers' Association, etc.

FIRST EDITION.

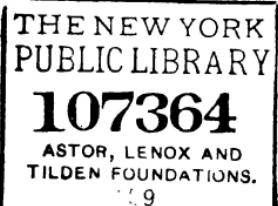
FIRST THOUSAND.

NEW YORK:

JOHN WILEY & SONS.

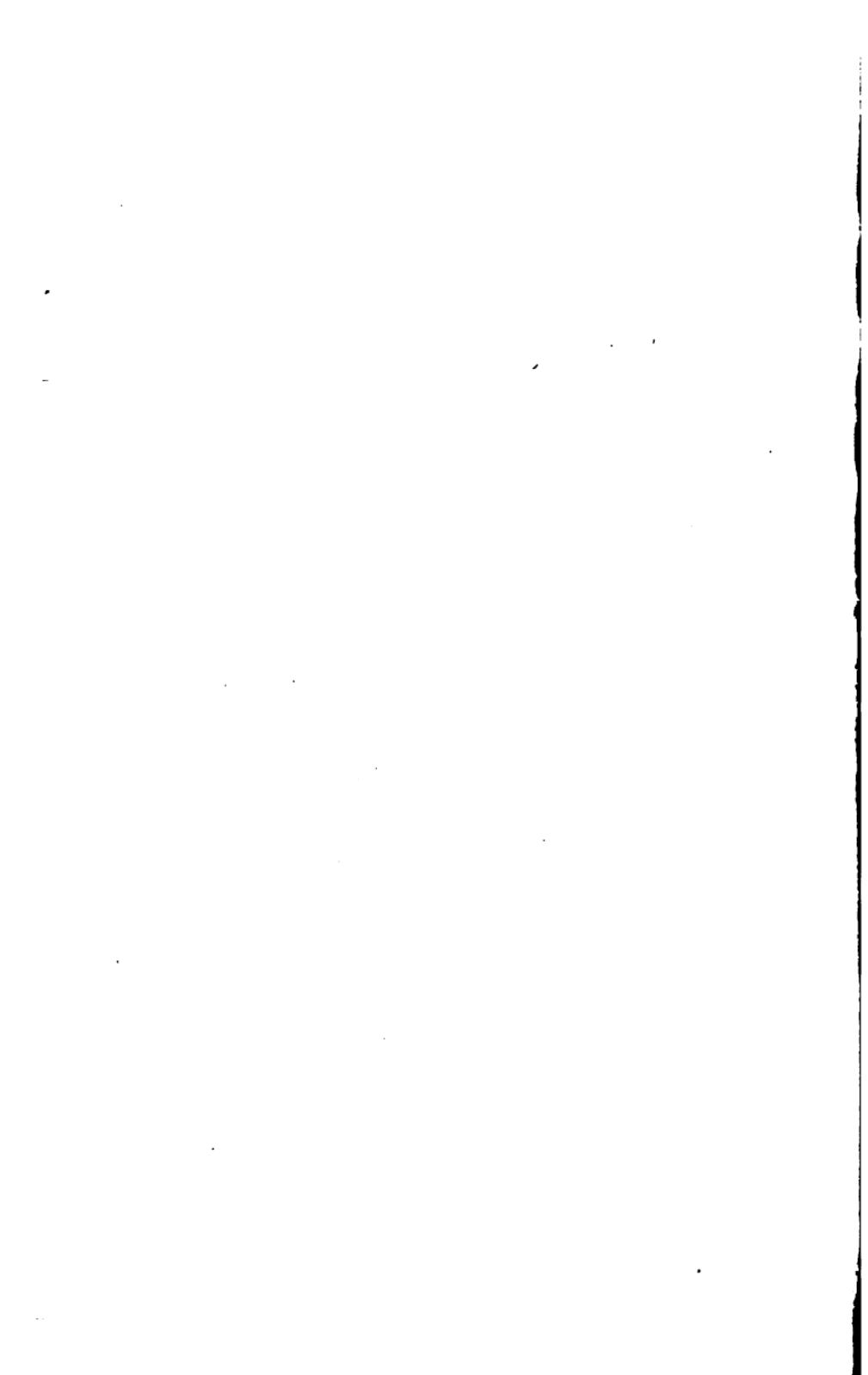
LONDON: CHAPMAN & HALL, LIMITED.

1899.



Copyright, 1899,
BY
SAMUEL T. MAYNARD.

To the thousands of home-makers who are trying to beautify their own homes and thus adding much to our already beautiful and prosperous country this little book is dedicated with the hope that it may aid many in the pursuit of knowledge of the most beautiful trees, shrubs, and plants and how to plant, train, and care for them so as to get the most real enjoyment from their growth and cultivation.



INTRODUCTION.

IN no country in the world are there so many well-to-do people as in the United States, and so many who own comfortable and even beautiful homes, and on every hand we hear the call for information as to the most beautiful decorative trees, shrubs, and plants and their proper use and arrangement to produce the most pleasing effects. The enormous trade in ornamental trees, shrubs, and plants among our nurserymen is an indication of the extent of the work of improvement and decoration that is going on among our people and the consequent need of knowledge and skill in order to make the best use of these materials.

The agricultural and horticultural press of the country has done much and is increasing its efforts to diffuse the needed knowledge. The nurserymen and dealers in ornamentals by their catalogues so profusely illustrated and scattered broadcast over the land are also helping on the good work, though in many cases by their undue praise of untried novelties they often lead the unskilled planter to make serious mistakes and great loss.

Landscape gardeners and architects have played a large and important part in developing the great beauty seen in so many of our country and suburban towns; the great majority of our people, however, those in limited circumstances who are straining every effort to pay for the home

they are building, are unable to avail themselves of their often costly advice, but must content themselves with obtaining from other sources such knowledge as will enable them to properly care for the ornamental trees, shrubs, or plants that they may be able to procure, and to so group and combine them with the lawn, the dwelling and other buildings, and with the surrounding conditions as to make not only a beautiful home-picture, but also to harmonize with any beautiful homes or estates adjoining or near by, that the beauty may be as widespread as possible.

While thus supplying the above call for knowledge in a concise and practical way has been the central idea in the construction of this book, the instructions in the principles of growth and care, grouping and arrangement, underlying successful work in home ornamentation are equally adapted to the more extended work of decorating large estates, parks, and other public grounds, and some few hints are given as to the management of public squares, school-yards, cemeteries, the construction of country roads, and roadside improvements.

It has been the author's aim to give plain and simple descriptions of each tree, shrub, or plant recommended, to present those that are of real value under ordinary conditions, and to give full and careful direction as to soil best adapted to the growth of each, and the special care, training, pruning, etc., required for their best growth.

In presenting this book to the public it is with the view of supplying the knowledge so much needed and sought for in a practical, condensed form that shall enable the home-owner and -builder, occupied with the daily cares of business, to make beautiful his surroundings; and the author hopes that, after more than 20 years of experience in teach-

ing and practising the art of ornamental gardening, he may be able to fill in a measure this long-felt want.

Many imperfections will, no doubt, be found in the work, for which kind indulgence and friendly criticism is asked, that such imperfections may be remedied in a revised edition at an early date.

S. T. M.

ACKNOWLEDGMENTS.

THE author wishes to acknowledge his indebtedness to those who have kindly assisted him in the preparation of this work, and especially to

The "*Country Gentleman*," Albany, N. Y., for the loan of woodcuts of Figs. 3 and 4.

ELLWANGER & BARRY, Rochester, N. Y., for the loan of electros of Figs. 78, 80, 85, 96, 98, 99, 100, 103, 106, 108, and 125.

THOMAS MEEHAN & SONS, Germantown, Philadelphia, Pa., for assistance in obtaining electros and the loan of Figs. 92 and 101.

F. R. PIERSON Co., Tarrytown-on-Hudson, N. Y., for the loan of electro of Fig. 16.

HENRY A. DREER, Philadelphia, Pa., for assistance in obtaining electros and the loan of Fig. 146.

CHAS. A. GREEN, Rochester, N. Y., and THE J. T. LOVETT Co., Little Silver, N. J., for assistance in obtaining electros.

The *Entomological Division* of the Department of Agriculture, Washington, D. C., for electros, specific acknowledgments of which have been made elsewhere.

The *New Hampshire Agricultural Experiment Station* for the loan of electro of Fig. 48.

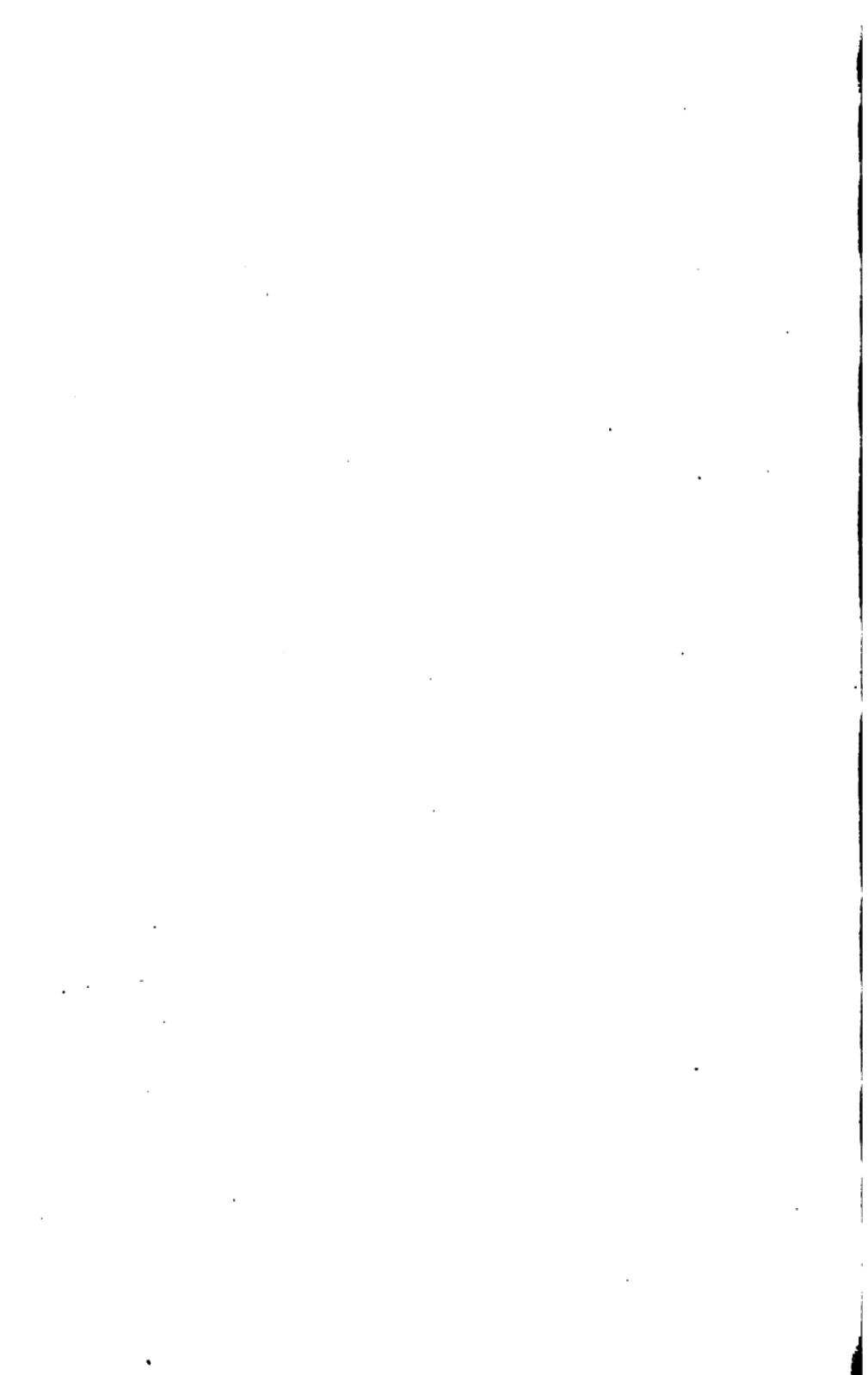


TABLE OF CONTENTS.

	PAGE
INTRODUCTION.....	v
CHAPTER I.	
LANDSCAPE GARDENING AND HOME ORNAMENTATION.....	1
Advantages of Home Ornamentation. Natural <i>vs.</i> the Artificial System.	
CHAPTER II.	
ORNAMENTING NEW HOMES.....	6
Conditions of Locations Considered. Secure and Improve Strongly Marked Natural Features. Location of Buildings. Architecture of the House. The Cellar and its Use. Heating and Ventilating the House.	
CHAPTER III.	
PREPARATION OF THE LAND.....	28
Grading. Making the Lawn. Fertilizing and Care of the Lawn.	
CHAPTER IV.	
TREES—THEIR PLANTING AND CARE.....	43
Importance of Trees and Shrubs. Improving Old Trees. Preparation of Trees for Planting. Planting and Care of Trees. The Arrangement or Grouping. Rules for Grouping.	

CHAPTER V.

	PAGE
SHRUBS, HEDGES, AND HARDY CLIMBERS	76
Methods of Grouping. Preparation of Land and Planting. Pruning and Care of Shrubs. Hedges: their Importance. Pruning and Training Hedges. Hardy Woody-Climbers: their Importance—Planting and Care of Herbaceous Plants: their Importance and Use. Tender Foliage or Flowering Plants.	

CHAPTER VI.

WALKS AND DRIVES.....	89
Importance. Extent, Width, and Distance. Construction.	

CHAPTER VII.

RENOVATING AND IMPROVING OLD HOMES.....	97
Preserving and Improving Old Trees. Renewing Old Shrubs and Hedges. Renovating Old Lawns. Removal of Fences and Walls. Farm Home Decoration. Combine Decoration and Forestry. Fruit-trees for Ornaments. Construction of Farm Roads.	

CHAPTER VIII.

COUNTRY ROADS AND ROADSIDE IMPROVEMENTS.....	111
Conditions Necessary for Good Roads. Broken Stone Roads. Repairing Roads. Care of Roadside Trees and Shrubs.	

CHAPTER IX.

PARKS, PUBLIC SQUARES, SCHOOL YARDS, ETC.....	124
Suggestions as to Parks, Public Squares, School-Yard Decoration. Cemetery Decoration. Renovating Old Cemeteries.	

CHAPTER X.

	PAGE
DESCRIPTION OF TREES.....	136
Street and Avenue Trees. Upright or Round-headed Trees. Weeping Trees. Trees with Deeply Cut Foliage. Trees with Colored Foliage.	

CHAPTER XI.

EVERGREEN TREES.....	180
Importance in Home Ornamentation. Transplanting and- Pruning. Best Varieties.	

CHAPTER XII.

ORNAMENTAL SHRUBS.....	190
How to Use with Best Effect. Transplanting, Pruning, etc. Best Varieties of Evergreen Shrubs. Importance of Climbing Shrubs. Best Varieties of Climbing Shrubs. Hedge Plants.	

CHAPTER XIII.

HARDY HERBACEOUS PLANTS, TENDER BEDDING AND CLIMB- ING PLANTS, ETC.....	223
Transplanting and Care. Best Varieties. Tender Bedding Plants—Best Varieties. Tender Climbing Plants—Best Varieties. Sub-tropical Plants—Treatment; Best Varieties.	

CHAPTER XIV.

AQUATIC PLANTS, HARDY FERNS, AND ORNAMENTAL GRASSES. 249	
Soil and Cultivation for Aquatic Plants. Best Varieties. Aquatic Border Plants—Best Varieties. Hardy Ferns—Use and Care of; Best Varieties. Ornamental Grasses—Impor- tance and Care of.	

CHAPTER XV.

	PAGE
INSECTS INJURIOUS TO ORNAMENTALS.....	261
Amount of Injury done by Insects. Remedies and Preventives from Injury by Insects. Insecticides and their Use. Fungi Injurious to Ornamentals. Rusts, Smuts, Mildews, Blights, etc. Fungicides and their Use. Spraying Pumps and Nozzles and their Use.	

CHAPTER XVI.

THE HOME FRUIT GARDEN.....	289
Amount and Kind of Land Needed. Location. Planting and Caring for Fruit-trees and Plants. Protection from Insects and Fungous Pests. The Best Varieties of Each Kind for Home Use.	

LIST OF ILLUSTRATIONS.

FIG.	PAGE
1. Frontispiece	1
2, 3. Arrangement of rocks.....	11
4. " " "	12
5. Underground overflow of lakelet.....	13
6. Open " " "	13
7. Buildings arranged on one side of lot	16
8, 9. Method of obtaining grade.....	30
10. Well about trees with deeply covered roots.....	31
11. Roots of trees covered on one side.....	32
12. Improper grading about dwelling.....	33
13. Grading to pleasing outline.....	34
14, 15, 16. Grading with curved surface.....	35
18. A perfectly formed tree.....	46
17, 19. Trees as found by roadside.....	46
20, 21. " " " "	47
22. Pruning of trees.....	47
23. " " "	48
24. Clustered growth of top of young tree.....	48
25. An old tree headed back.....	49
26. Arrangement of trees along narrow streets.....	52
27. Group of trees	63
28. " " " and shrubs.....	68
29. Trees planted in too formal manner.....	68
30. " " " natural groups.....	68
31, 32. Trees and shrubs grouped along walks.....	69
33. " " " planted to obtain vistas.....	70
34. " " " " " "	71
35. Effect of screen-trees at different distances.....	72
36. Trees and shrubs grouped at gateway	73
37, 38. " " " " on crown of rounded surface....	74

FIG.	PAGE
39. Trees and shrubs grouped at branching of walk or drive...	78
40, 41. " " " " at end or turn of walk or drive..	78
42, 43. Cutting back of hedges.....	82
44, 45, 46. Forms of hedges.....	83
47. Pruning hedges.....	83
48. Vine-covered cottage.....	85
49. " on cottage pruned.....	87
50. Combined walk and drive.....	91
51. Semicircular walk or drive.....	91
52. Method of obtaining curves.....	93
53, 54. Section of walk showing drainage.....	94
55. Results of too close planting.....	96
56, 57. Shrubs divided and pruned for planting.....	98
58. Pruning shrubs or hedges.....	98
59. Covering up bank wall.....	102
60. Turfing against stone wall.....	103
61. Section of ordinary country road.....	113
62. " " macadam or broken-stone road.....	113
63. A properly constructed road-bar.....	116
64. An improperly constructed road-bar	116
65. " " " gravelled road.....	114
66. A properly " "	115
67, 68. Arrangements of school-yards.....	128
69. " " "	129
70. City street without trees.....	134
71. A well-decorated city street.....	136
72. American elm.....	138
73. Silver maple	138
74. Red oak, pruned	139
75. Japanese maple.....	145
76. Catalpa speciosa.....	148
77. White-fringe.....	150
78. Flowering dogwood.....	151
79. English hawthorn.....	152
80. Soulange's magnolia.....	156
81. Oak-leaved mountain ash	159
82. White oak	160
83. Pin or swamp oak.....	162
84. Cut-leaved weeping maple	165
85. " " birch.....	166
86. Weeping beech.....	168

FIG.		PAGE
87.	Weeping mulberry.....	169
88.	Camperdown elm.....	170
89.	Rivers' purple beech.....	175
90.	Colorado blue spruce	179
91.	Nordmann's fir.....	180
92.	Austrian pine.....	181
93.	Japanese cypress.....	182
94.	Siberian arbor-vitæ.....	184
95.	Japanese azalea.....	187
96.	Barberry, fruit.....	188
97.	Sweet pepper-bush	189
98.	Variegated dogwood.....	190
99.	Japan quince	192
100.	Weigela rosea.....	193
101.	Exochorda grandiflora.....	194
102.	Golden-bell	195
103.	Hardy hydrangia	197
104.	Calycanthus.....	198
105.	Mock-orange.....	199
106.	" large-flowered.....	200
107.	Purple-fringe (smoke-tree)	200
108.	Bridal-wreath	202
109.	Van Houtt's spiræa.....	204
110.	Japanese snowball	205
111.	Bedding-roses.....	208
112.	Moss-rose	208
113.	Climbing rose.....	209
114.	Japanese rose	210
115.	Rhododendron Catawbiense.....	212
116.	Vine-covered cottage in June.....	213
117.	" " " April	214
118.	Japanese woodbine	214
119.	Clematis Jackmanii, C. Henryii, C. paniculata.....	215
120.	Japanese honeysuckle.....	216
121.	Chinese wistaria.....	217
122.	Trumpet Creeper.....	218
123.	Cut-leaved pæony.....	225
124.	Garden phlox.....	224
125.	Moss-pink	225
126.	Hollyhock.....	226
127.	Columbine	227

FIG.		PAGE
128.	English daisy.....	228
129.	Lily-of-the-valley.....	229
130.	Carnation-pink.....	230
131.	Plantain-lily.....	231
132.	Hardy sunflower.....	232
133.	Japanese iris.....	233
134.	Oriental poppy	234
135.	Pansy.....	235
136.	English violet.....	236
137.	Yucca.....	237
138.	Golden-banded lily.....	238
139.	Dutch bulbs.....	240
140.	Sweet pea.....	241
141.	Canna.....	243
142.	Castor bean.....	244
143.	Caladium	245
144.	Papyrus, reed paper-plant.....	246
145.	Abyssinian banana.....	247
146.	An aquatic garden	249
147.	East Indian lotus.....	251
148.	Rose-flowered water-lily.....	253
149.	Purple African water-lily.....	254
150.	Water-poppy.....	255
151.	Parrot's-feather.....	257
152.	Pampas-grass.....	259
153.	Japanese plume-grass.....	260
154.	Elm-beetle.....	270
155.	Elm-scale.....	271
156.	Maple-borer.....	273
157.	Canker-worm	274
158.	" "	275
159.	Round-headed apple-borer.....	275
160.	Flat-headed apple-borer.....	276
161.	Peach-borer	276
162.	Rose-bug or -chafer.....	277
163.	Rose-slug.....	278
164.	Oyster-shell scale.....	281
165.	San José scale.....	282
166.	Maple-scale	284
167.	Plan of fruit-garden.....	289
168.	" " strawberry-bed.....	311

LANDSCAPE GARDENING.

CHAPTER I.

LANDSCAPE GARDENING AND HOME DECORATION COMPARED.

THE term "landscape gardening" properly is applied in the more extended meaning of the words to that larger work of making and decorating extensive estates, parks, etc., where distant views (landscapes) may be obtained within their limits and by the work of the gardener or landscape artist.

Very little of this kind of work can be done in this country because of the small areas owned by most of our people, and the term "home decoration" or "home landscape gardening" will more properly apply to most of the work done among us in this line. Yet when we consider that outside the limits of cities and large towns there are large and extended views which even the owner of the smallest estate may take in or shut out at will in the arrangement of his own decorative trees and shrubs, the work of home decoration becomes in a true sense landscape gardening.

We can and do to a greater or less extent include the

whole landscape in the decoration of all home grounds if we wish to obtain the best results. There is hardly a country or suburban home so shut in as not to afford some scope for the appropriation of outside vistas of beauty beyond its limits, and in many cases views for miles around may be found and improved or toned down or heightened by careful treatment in our own planting; and in more closely planted districts, by mutual understanding and co-operation, the real art of landscape gardening may have as broad scope as in the park and large estate.

Knowledge of Materials.

Before considering so large a subject in detail, the necessity must be urged upon the reader of becoming thoroughly familiar with the materials to be used—i.e., the ornamental trees, shrubs, plants, grass, rock, etc.—for until this knowledge is obtained it will be a very difficult matter to begin the work understandingly or to carry it out to successful results.

In Chapter X will be found a full description of all the most beautiful trees, shrubs, and plants, their most appropriate use, the soil best suited to their growth, the special treatment they each require, and in Chapter XV the diseases and insect pests they are subject to, with remedies for the same. Frequent reference will be made to these chapters, and for a full understanding of each case it will be advisable to give these references full consideration.

A Plan.

Before any one, skilled or unskilled, begins to decorate a place, no matter how small, he must have some plan for

the work, and the more complete and fully matured that plan the better.

Many individuals who have a special love for the beautiful in nature, who are familiar with a large number of the most beautiful trees, shrubs, etc., and have studied the effects of their varying forms, size, and colors, and who are about to build a home, are qualified to make a satisfactory plan for themselves, and a large amount of pleasure may be the result of this work.

This study of art and nature is one of the best kinds of training of the perceptive faculties. Nothing can better train the eye and thoughts to see and love the beautiful than this work, and it has a most refining and elevating effect upon those who thus spend their leisure hours.

If proper time is given to the subject, and the advice of those who have had some experience is sought, there need be no difficulty in making a good working plan by the amateur. The father and the mother should both be interested and plan together, and the children too should have a voice in the matter, for there is nothing that holds them to the old home as the trees and plants they have planted or helped to plant and care for.

When cost is not an item of consideration, a complete plan made by a skilled landscape gardener who is willing to incorporate, as far as possible, the particular species of trees and plants and other features desired by the owner, will give the most satisfaction; but the value of the study and training to the individual is lost; therefore I would advise every home-builder to make a great effort to learn what are the best decorative trees, shrubs, and plants for home planting, and how best to succeed in growing them to the greatest perfection.

Some failures will be made, but success will at last crown our efforts, and the things we have planted, the walks and drives we have located, and the other objects of beauty we have created about our homes will be ours in a sense that they cannot be if we build after the plan of others, and a most precious source of joy and comfort in declining years.

The Natural versus the Artificial System.

In earlier times and in other countries much of the work in landscape or ornamental gardening was, done in what is known as the *geometrical* or *artificial system*, where the work was largely laid out in squares, circles, or other geometrical figures; the changes in grade were largely obtained by steep terraces, the trees and shrubs trained to regular and often grotesque forms. In our own country the *natural system* is more largely used, and more and more in Europe it is coming into use, where all the work is done so as to represent the best and most beautiful in nature. By this system the walks and drives are laid out in graceful curves, the changes in grade made by graceful slopes and rounded surfaces, and the trees and shrubs are encouraged to take the most perfect natural forms, while they are so grouped as to give the greatest variety of natural beauty.

Under some conditions, as in squares or city lots, close up to large, tall buildings, with paved roads and sidewalks, on steep hillsides and abrupt slopes, or where the terrace or retaining wall is a necessity, the artificial system may not be objectionable, but in the country, with so much of freedom of thought and action, and so full of natural growth and beauty, the artificial style is not in good taste and should generally be avoided.

The house and surrounding buildings, walks, drives, fences, etc., must of necessity be artificial, but even these may be toned down in their architecture and coloring so as to blend and harmonize with the natural ornamental features about them.

New Homes and Homes Already Established.

In considering the subject of home decoration it becomes necessary to discuss it under two heads: 1st. New homes where nothing has been done toward outside decoration; 2d. Homes already established.

CHAPTER II.

ORNAMENTING NEW HOMES.

IN establishing and decorating new homes the following important points must be considered: Location, healthfulness, convenience, elevation and slope of land, good water, kind of soil, strongly marked features, as rock and water, etc.

Location.

Everywhere about us, except in the heart of the large cities, are to be found building lots with more or less land for lawn and garden purposes. On hill and in dale, among the mountains, by the seaside, in the suburbs, and in the remote country, everywhere are places in such profusion that those of the most limited means, the most wealthy and of the most fastidious tastes, may find a location suited to their requirements.

Whether one shall locate a new home in the city, in the suburbs, or in the country is a question that cannot be answered without a complete understanding of all of the conditions involved. Each has its advantage, and every side of the question should be very carefully studied before a decision is made, for not only one's own personal welfare is involved, but in many cases that of others near and dear, and when once located a change cannot be made with-

out a great inconvenience and in some cases great loss financially.

Healthfulness of Location.

This is of the first and paramount importance, for without health no one can enjoy life or do his share toward making his own life or that of others of value. And first of all low and swampy or malarial land should be avoided. While much may be done by underdraining, and other means be employed to make such locations healthful, with so many thousands of acres about us free from these objections there is no necessity for a single dwelling being located on unhealthful ground. Rising land with good drainage, where the surface-water shall quickly pass off, where there shall be an abundance of moving air about the site, and an abundance of sunlight, is the most desirable.

Convenience.

The location should be convenient of access not only for the occupants but for all who may be in contact with them. Many a family have shut themselves out from society almost completely by building a home where friends can only meet them by making a very unusual effort.

The leading idea of modern times is centralization; and the advantages of being near neighbors where social intercourse can be frequent, where the whole family will be brought into close contact with the surrounding world, are many; but it becomes a question if the individuality, the strong characters brought out by the self-reliance acquired by living in more isolated sections, are not worth considering also. The electric railroad, penetrating far into the country, connecting town with town and country with town,

will in a measure settle the question of the necessity for centralization and the depopulation of our rural districts.

Nearness to railroad, to school and church must be carefully considered; but as the cost of building lots remote from these conveniences are much less, those limited in means will continue to locate in the less favored sections.

The main street of the town or village has many advantages, but the cross or side streets have the advantages of greater quiet and allow of more freedom of action, besides being less expensive.

Elevation and Slope.

The height of the land above the sea-level and above the surrounding country should be considered. The higher the land the better and purer the air, the larger and more pleasing the landscape effect, and more perfect drainage may be obtained. There are, however, serious objections to extreme elevation and abrupt slopes which increase the effort needed to get to and from the place, and increase the cost of fitting the land and keeping lawn, walks, and drives in good condition. A southern or southeastern slope will afford much shelter where the prevailing winds during cold weather are from the north or northwest, and, if the landscape effect is equally good, should be selected in preference to a western or northwestern slope.

Good Water.

Nothing can make home life more miserable than an insufficient supply of water or water that is of poor quality, and the most careful investigation of this question should be made before deciding upon a location. If there are any

conditions that may lead to the contamination of the drinking-water, they should have the most rigid investigation. With the modern methods of analysis it is possible to know positively the condition of the water, but analyses should be made at two or three different times to determine if the supply is affected at one season of the year and not at another.

In villages and near old buildings most dangerous sources of contamination may be found in sink-drains, cesspools, stable-yards, etc., and if any of the above are found within from 200 to 300 feet, according to the soil, of a well the water should be regarded with suspicion.

These sources of contamination may not affect the water in a new well for many years, but sooner or later the surface-drainage will find its way down to the deep basins formed by our wells. The safest water-supply is that from a well-constructed and cared for reservoir, brought in suitable pipes to the house. In these open reservoirs the water becomes purified by long exposure to the air, but does not possess the sparkle nor the coolness of water from a deep well.

Kind of Soil.

While the location as to surroundings, elevation, water-supply, etc., are matters of first importance, the success and more or less the cost of the ornamental planting depends largely upon the nature of the soil. It will hardly be possible to find a soil perfectly adapted to the best growth of all kinds of trees, shrubs, and plants, yet any ordinarily good soil may be made to grow most of them without very great expense. The best soil for general purposes is a deep sandy loam, though a strong loam with a clay subsoil if thoroughly underdrained will often be satisfactory and, a thin soil, too, may be very much improved by deep working

and heavy manuring, but in the two latter cases the expense of preparation and maintenance is very much increased.

**Strongly Marked Natural Features, like Rocks and Water,
Distant Views, etc.**

These prominent natural features often found on building lots and surroundings should always be carefully considered, for they may be made to add wonderful beauty and variety if properly handled.

ROCKS.

Large boulders and ledges should be preserved wherever possible, but the small boulders, loose rocks, and cobbles should all be put out of sight in well-kept grounds. The latter may be utilized for foundations for small buildings and for filling in the beds of walks and drives, or otherwise disposed of where out of view. The practice of dumping them along the roadside, which we find in many country places, cannot be too severely condemned, for it renders the destruction of weeds and brush that come up among them almost an impossibility. If all the loose stones and cobbles could be removed from the borders of our roadways throughout the country, weeds and other objectionable growth could be easily kept down and the roadsides be soon covered with grass and desirable trees and shrubs.

Ledges and boulders serve as a nucleus around which to group the ornamental trees, shrubs, and vines, and give an added naturalness and beauty that can be obtained in no other way. Large boulders may often be arranged in such a way as to give a steep embankment the appearance of a projecting ledge as in Fig. 2, and which shows them arranged upon both sides of a cut through which a drive

or walk can be arranged with good effect. Fig. 3 illustrates boulders grouped on one side of a slope with very pleasing

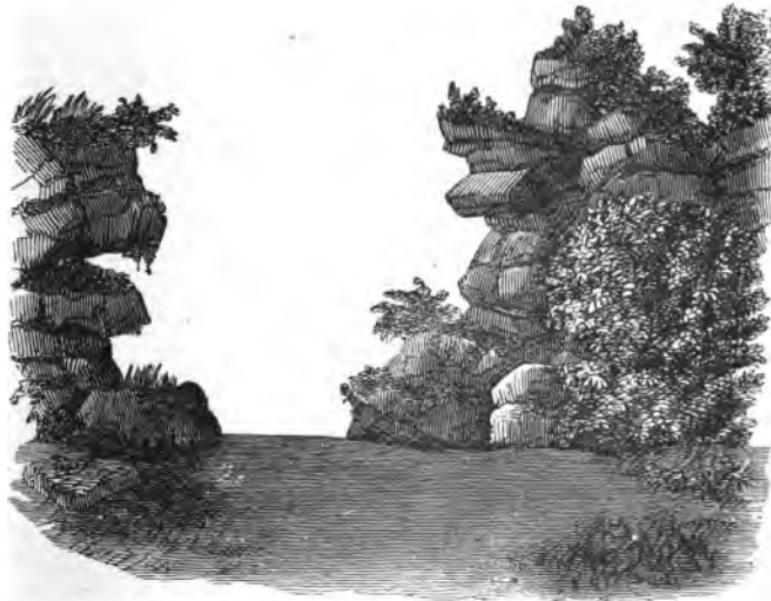


FIG. 2.—ARRANGEMENT OF ROCKS.



FIG. 3.—ARRANGEMENT OF ROCKS.

results. Fig. 4 shows a very unnatural and inartistic arrangement which would be greatly improved if trees,

shrubs, and plants were planted around and among them. As much of the naturalness about these strong features as possible should be preserved. The trees, shrubs, and vines, the herbaceous plants and grass should be made to grow to greater perfection than in their wild condition, by careful



FIG. 4.—ARRANGEMENT OF ROCKS.

attention and enrichment of the soil, and undesirable things should not be allowed to grow; thus will art and nature be combined and true beauty produced.

WATER.

Close proximity to lakes, ponds, or streams may not always be desirable, but where there is open country about the place, with an abundance of sunshine and air, and the land is somewhat elevated above the water, few natural features can be made to produce so much beauty and pleasure. A vista of water, either moving or silent, through an opening in the shrubbery adds at once a quiet and a charm of which one seldom tires.

Moving water gives more variety, adds life and vivacity to the landscape, while the peaceful lakelet or pond has a quieting effect. In places where there is much of the bold and strong in the decoration the surprise and variety given by the quiet lakelet is very pleasing, while where the quiet, graceful features predominate a little moving, active water is equally valuable. In making confined sheets of water, if the source of supply is abundant, so that there is fre-

quent renewal of the water within the basin, the outlet may be through an underground overflow as shown in Fig. 5.

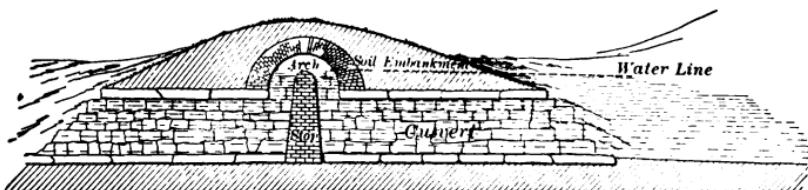


FIG. 5.—UNDERGROUND OVERFLOW OF LAKELET.

If the supply of water is limited and not likely to be frequently renewed, the open overflow or outlet, as in Fig. 6,

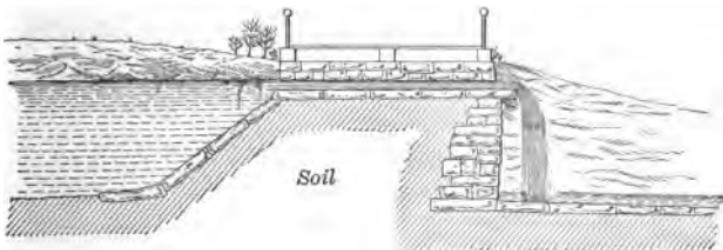


FIG. 6.—OPEN OVERFLOW OF LAKELET.

should be made, so that any foul substances that accumulate on the surface may be easily carried off. With the underground outlet it requires a tremendous volume of water to carry such light surface-material down into the culvert even one or two feet below the surface of the water.

The low murmur of the brooklet, or the dash of the cascade or waterfall, has charms for almost every one and should be made a most prominent feature wherever available. Even if not on one's own grounds, by a little manipulation of shrubbery water-views may often be secured through open vistas.

The location of the home in the vicinity of stagnant water or where streams or ponds are likely to be contami-

nated by sewage or undesirable surface-drainage should be avoided unless there is some certainty that the surroundings can and will be improved.

Increase in Value.

No thrifty person will think of locating in any place where, if by change of business or other circumstance they might be obliged to make a change in location, the property will not sell for something near its cost. In a great many localities, where near good railroads and thriving manufactories, property is almost sure to increase in value if a good selection is made and the home is economically built, while in others, more distant from business centres, real estate has gradually diminished in value, until we often find good home farms offered for sale for much less than the cost of the buildings upon them.

Amount of Land to Purchase.

One of the greatest mistakes many people make when establishing a new home is in purchasing too much land, especially if they are persons of small means and little experience in caring for land. The amount that should be purchased ought to be limited to the actual needs of the purchaser. If means are abundant and extensive grounds and a large lawn with choice shrubbery is desired, or if more or less gardening is to be done, more land can be utilized, but even then the quantity should be limited to what can be *well* cared for.

The home garden is one of the greatest luxuries connected with a comfortable home, provided one has the knowledge and skill to make the work a success and has

the time to either do the work or to see that all the operations of planting, cultivation, and harvesting are properly done. To the professional man, the business man, or mechanic of sedentary habit the physical effort necessary to successfully care for a small garden of fruits and vegetables will be invaluable and one of the best means of securing vigorous health, while the products of a well-kept garden have often been made to supplement many a meagre income and provide the most healthful and appetizing food possible to obtain.

But this caution should be observed: Do not undertake this work on a large scale until some skill or experience has been obtained. Small areas well tilled in all lines of agriculture and horticulture generally give the best results, and only so much land should be given to garden purpose as can be cared for in the most thorough manner. If land is abundant, a part of it might be set off to the children for a flower-garden, for the planting of a few trees or vines, or for growing a few vegetables like melons, etc. In no way can so much of nature and her ways be taught to children and a real love for all her products be fostered, as well as a strong love be developed for the home which they have helped to build.

Location of Buildings.

After deciding where to build a home, the first question to decide is where to locate the house. Nothing can be more important. In building a house it is with the idea of permanent occupancy or for a long series of years, and any mistake made at this stage is often irreparable.

Wherever possible the house should be located at some

distance from the street; the building will look better, and more natural and beautiful decorations can be made than if it is almost on the street-line. In suburban districts where there are already many houses located, to place the building very much out of the line of those already built sometimes detracts from rather than enhances its beauty. With an abundance of room between the house and street one is less troubled by dust and noise, and better views of the building and grounds can be obtained from the street, and better opportunity is afforded for securing vistas of beauty and variety in looking from the house.

Where the lot is long and narrow and small in extent, say less than one fourth of an acre, greater variety may be obtained by placing the house somewhat at one side as in Fig. 7. This affords better opportunity for decoration, the

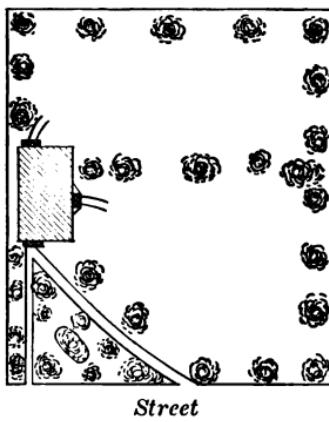


FIG. 7.—BUILDINGS ARRANGED ON ONE SIDE OF LOT.

use of larger trees and shrubs, and greater extent of lawn. In places of larger area a central location may be more desirable, as the balance of the picture or better symmetry is more readily obtained.

Elevation of the House.

No more frequent mistake is made by builders than in the elevation of the house. It is very difficult for an inexperienced person to judge how a house will look after the excavation has been made and the soil is brought up to a grade. The elevation should be such that there shall be perfect surface and sub-drainage, that all water shall pass off quickly. The elevation must also be sufficient to secure a perfectly dry cellar.

The view, too, must be considered, and it will be found that this is best when seen from a little above surrounding objects, and the beauty of the house and grounds is much increased if seen from a little below the level.

The cost of excavation and filling is a matter that must be considered, and if the soil taken from the cellar is not sufficient to do the grading it must be obtained from the nearest source of supply of good material.

Exposure of the House.

Whether the house shall be on the north, south, east, or west slope is a matter of great importance in our changeable climate. On the southern, southeasterly, or southwesterly slopes a little under a hill or in the lea of a sheltering grove, the fierce northwest winds, so common throughout the country, are greatly modified, but some of our most lovely views are often lost under such conditions, and it becomes a matter of serious moment which of the two conditions to adopt. Shelter is very easily provided, however, in a short time by planting trees of rapid growth.

The location as related to the principal thoroughfare is a

matter that should receive attention. On the north side of a road leading east and west the front of the house will be open to the south, and the front rooms are thus exposed to the sun more fully than the rear rooms. If, however, more sunlight is desired in the rear rooms, a location on the south side of the street would be more satisfactory. Hallways and unoccupied rooms should be placed where there is the least sunlight.

But whatever the exposure, the aim should be to obtain shelter if possible from the prevailing winds, to secure as much sunlight as possible and preserve the most beautiful views.

Character of the Land.

The beauty that may be developed in any place depends largely upon the character of the land. If without character, i.e., if perfectly flat and level, no marked or strong features can be obtained except at a greatly added cost. If, however, the land is uneven, with a valley here, a hill there, a ravine in one place or a mass of bold rocks in another, much more variety and much more beautiful views may be obtained. Whatever variety is obtained on a level building lot must be made by the contrast between the ornamental trees and shrubs and the architecture.

Architecture.

In building a new house the architecture should be in keeping with the surroundings and within the means of the builder. The most unsatisfactory results are often shown where a large showy house is built in a quiet unpretentious place, or where the owner has put his last dollar into it and can do nothing toward decoration, but must leave the place

in an unkempt and slovenly condition. Many a home is built too large to be properly furnished or cared for, and thus becomes a source of anxiety and disappointment.

The simple, plain, well-built structure, with surroundings neatly planted and kept up in a neat and finished manner, has more attractiveness, is more enjoyed by the occupants, and adds much more to the appearance of thrift and comfort of a community than the large showy buildings without tasteful decoration and outside care.

While beautiful trees and shrubs may be grown and artistic arrangement of all of the material for home decoration be just as well made about a dwelling that has no features of beauty in itself, more satisfactory results may be obtained if the buildings harmonize with the natural surroundings.

If the buildings are already established, little can be done but adapt the decorations to their characteristics. Much greater beauty is added to the broad, low house by introducing some slender, spiry trees than by using all low-spreading trees, while with the Gothic or other light, high styles of architecture many of the graceful and low-spreading trees may be grouped with some of the spiry kinds. In every case there must be a blending of the materials used for decoration with the architecture.

Plans of Dwelling-houses.

So much is written at the present time on suburban architecture that no attempt will be made in this volume to give plans for such work. The reader is referred to the numerous works on the subject and to the many careful and well-elaborated plans to be found in our agricultural, horticultural, scientific, and literary papers which, with a

fair amount of taste in the decorative art and the assistance of a good builder, will enable one to decide understandingly what is needed and in many cases dispense with the expensive services of the professional architect.

In cases, however, of extensive buildings of considerable cost it will be found economical to have a full detailed plan made by an experienced architect. With a full understanding of all of the needs of the family which are to occupy the dwelling, the skilled architect will be able to obtain desired results and save many mistakes that the inexperienced would be likely to make, often saving the owner many times the cost of a working plan.

There is, however, a growing taste among our people for amateur architecture which should be encouraged, and many beautiful and well-arranged plans of all kinds of buildings have been produced by those about to build houses; and the pleasure experienced in building a house of one's own planning may more than counterbalance any saving in material or labor that might result from a plan made by a skilled architect.

Cost of the House.

It is the almost universal experience of those who build a house for the first time, especially those with limited means, that the cost largely exceeds the estimate, and this has led to the practice of adding 25 to 50 per cent to the estimate as it is ordinarily made. This deficiency may be accounted for generally by the fact that there are so many little things that go to make up the completed house that are overlooked or that are not incorporated in the builder's contract, and whenever a building is done by contract the most full and complete specifications should be made out.

Where reliable builders can be found who will look to the interest of the employer as well as their own, much more satisfactory results may be obtained if the work is done by day labor than if by contract.

The requirements for a healthful house are, first,

Good Drainage of the Cellar.

A wet or even over-moist cellar is often the cause of much sickness and discomfort, for it serves not only as a place for the development of disease-germs, but also those that cause the decay of the woodwork and hastens the corrosion of any metal substances stored therein. It causes contraction and expansion of doors, windows, casings, and floors, and gives no end of trouble in many ways. From its long use for storing vegetables, etc., we have come to think that a cellar is almost a necessity, but it is not so much so at the present time as when almost every family put in a large supply of provisions for winter use. Now the provision-dealer puts in large supplies and is ready to deliver fresh vegetables and fruit in limited quantities every week, or even every day if desired.

The cellar is useful in the modern house, however, not so much for storing winter supplies as for the location of the furnace and the needed fuel. In the "good old times" our houses were heated by burning large quantities of wood in the fireplaces; then came the stove, one in each room; and finally we have come to centralizing all heating apparatus in one furnace or boiler, which, until we come to the condition where all heat can be supplied to our dwellings from outside central stations, either by steam, hot water, or electricity, is by far the most satisfactory arrangement we find now available.

A well-drained cellar with a good furnace to dry out surplus moisture is a good place for storing fuel and other necessities, and is easily accessible for regulating the heat-supply.

In every case proper means should be provided for getting the coal and other fuel in and for taking out the accumulating ashes in such a way as not to necessitate crossing long distances of lawn with heavily loaded teams. The bulkhead or entrance into the cellar should therefore be located with this in view.

As far as possible all vegetables and fruit should be stored in the cellar of some outbuilding or in some frost-proof vegetable or fruit room above ground, and except for the furnace and the fuel-supply a cellar is not a necessity in building the modern house.

Where perfect drainage can be obtained at little expense, under many conditions the cellar is desirable, and the space provided by its construction is much more cheaply obtained than in any other part of the building. Upon side-hills where basement rooms can be constructed the space becomes still more valuable for kitchen, laundry, and other purposes.

The surface-drainage of all water from the roofs and all surrounding land should be first provided for by proper grading, so that it shall pass off quickly and without washing of the soil. The water from the roof should never be allowed to fall from the eaves to the ground near the foundations, but should be conducted in pipes and gutters as far away as is possible. Where the slope is very abrupt from the house, underground conduits should be provided to prevent surface-washing. Subdrainage should be provided along the inside of the cellar walls, and deep enough below the bottom to make it perfectly dry. If the soil

outside is naturally wet or springy, a line of tile should be placed at such distance and depth as to make this perfectly dry. With a cellar bottom thus drained outside and in, and carefully concreted with cement and sand, the most healthful condition possible will be provided.

Perfect Ventilation.

This is a very large subject to even touch upon in a work of this character and limit, but is one of so much importance that no one who intends to build a home, however simple, should ignore it.

The first condition to be provided is sufficiently large space for taking in pure and forcing out the impure air in sufficient quantities for healthy respiration of the inmates. This is best provided by having open fireplaces in each of the principal rooms, or by means of separate flues for the inlet of fresh air and egress of the foul air, a draft being created in the flues by heat produced by a gas-jet, a coil from steam- or hot-water pipes of the boiler, or from a separate stack heater.

Economy of fuel demands a close construction of the building by lining the walls with some non-conducting material like paper, building-felt, etc., and in very cold weather it is a matter requiring serious consideration how to heat the necessary amount of cold fresh air that we must have for health. The single thickness of window around which so much fresh air would enter we cover with storm-sash, our doors we make close with weather-strips, and the only source of fresh-air supply must be through the cold-air box that leads into the furnace or ventilating flues. If this is sufficiently large and properly regulated, and a quick

draft is made by the flue being heated with a fire, gas-jet, or hand-lamp in the grate or open fireplace, or a coil or other heating appliance in a separate flue, pure air will be constantly supplied; but if the cold-air box is kept closed and no adequate escape is provided, the closely built house becomes a place for the generation of disease and ill health. The most approved method of arranging the heat-supply and foul-air escape is to have the former enter the room *near the ceiling* and the latter to pass out *near the floor* on the same side, thus causing a full sweep and circulation of air in all parts of the room. If the heat enters on one side and passes out on the opposite side, the current of heated air may go directly across the room in a narrow current and the air at the sides of the room be imperfectly renewed.

Heating the House.

Steam, hot water, and hot-air furnaces are all largely used for heating dwellings, and each has strong advocates among practical and scientific men, but which of them will give the best results depends upon so many conditions that no attempt will be made to decide the question here. With either steam or hot water enclosed in coils or radiators separate systems of ventilation should be provided by the open fireplace or the separate flue.

Convenience in Arrangement of Rooms.

In many homes the loved inmates are often in a few years forced to travel many unnecessary miles or suffer great inconvenience because of the poor arrangement of the important rooms of the house. The house should be adapted in every way to the conditions of the inmates. If

the housework is to be done by members of the family, the kitchen and dining-room should be easily accessible to the sitting- or living-room, and every possible arrangement for comfort and ease of doing the work should be provided. If servants are to be employed, and such often becomes a necessity, then the kitchen should be as remote from the sitting-room as is possible to avoid odors and noise, but both kitchen and sitting-room should be easily accessible to the dining-room.

It is the practice of most of our people to build too high. The house with most of the rooms on the first floor has a hominess and brooding character that is especially adapted to country life, and much time and effort is often saved to the inmates by this style of building, though perhaps the cost of building a given number of rooms may be somewhat increased. In locations where the land is low and fogs and dampness are prevalent and where land is expensive the two- or even three-story building may be advisable.

An abundance of shelf- and closet-room should be considered as important as large rooms. Neatness, order, and economy of time are thus encouraged in all of the inmates by having a convenient place for everything and keeping everything in proper condition in its proper place. There should be an abundance of shed- and storage-room in the outbuildings for the general comfort of all and for keeping up the necessary outside work of the home.

Sunlight in every room of the house is necessary for good health and should be provided for by the location and architecture of the house.

In the square-box house, though undoubtedly the cheapest to build, some of the rooms will receive but little

sunlight. But by arranging the rooms in more or less of the cross form, or by the addition of wings, bay windows, etc., the fullest amount of sunlight can be obtained.

The recent improvements in styles of dwellings and the adoption of large or numerous windows are steps in the right direction. With the present low price of glass, and sash and doors made so cheaply as they are in our large factories, large windows and many of them to provide an abundance of light need not add materially to the first cost of a dwelling, and by the use of storm-windows during the winter little or no increase in cost of heating need be experienced.

Plumbing.

Every possible attention should be given to the plumbing and sanitary arrangements of the house and outbuildings; the limits of this book, however, will not allow of an extended discussion of the subject. The reader is referred to the many books written by practical men and women on this subject, such as "Home Sanitation," by Mrs. Ellen M. Richards and Marion Talbot; "Sanitary Drainage of Houses and Towns" and "Principles and Practice of House Drainage," and other works of Geo. E. Waring, Jr.; "Women Plumbers and Doctors," by Mrs. H. M. Plunket; and many other works on the subject of house-drainage and plumbing should be carefully studied.

The work of plumbing requires much skill and patience, and only skilful and practical men should be employed to do this very important work. The "*plumber's bill*" is proverbial, and the complaint often made against their

exorbitant charges are in some cases founded upon facts, but there probably are as many honest men in the plumbing business as in many other lines of work. To have a nice, thoroughly fitted job of plumbing done requires time and the best of material, together with skill on the part of the workmen, all of which are expensive.

CHAPTER III.

PREPARATION OF THE LAND

IN the preceding chapters the requirements of the house and other conditions have been discussed in a general way, and it now becomes necessary for us to take up in detail the preparation of the soil for the growth of the various kinds of trees, shrubs, and plants used for the outside ornamentation of the home.

Before any decoration of the grounds can be begun the house must have been finished and the débris removed from the land. It must be fully understood that upon few, if any, places can there be found all of the varieties of soils necessary for the growth of all of the ornamental material that it may be desirable to grow, and often it will be necessary to procure such materials to improve it as is needed from outside sources. In many cases, however, we find the soil well adapted, with slight additions, to the growth of all the kinds of trees, shrubs, and plants that it is desirable to grow, in which case the cost of preparation is much reduced.

Preliminary Grading.

When the excavation is made for the cellar, the surface-soil should be scraped to one side and the subsoil to another, that the former may be used to make the surface-

covering over any places that may have been deeply filled in with poor material. Whenever fills are to be made of considerable depth, as the foundation of the drives and walks, basins and valleys, the surface-soil, if it is needed or can be utilized, should be first shovelled or scraped to one side and then be graded over such coarse material as may be used for this filling.

The surface should slope away in all directions from the house, so that there shall be no surface-water standing at any time during the year within several yards of it, and in *no place* on the lawn should there be basins where the water shall stand for any length of time after heavy showers, or during heavy rains or melting snows in the winter and spring. In the latter case, especially if ice is formed upon the lawn, the grass will often be smothered (winter-killed) or drowned out, so that much labor will be required to reseed and bring it into good condition again. Thorough and deep underdraining will in a measure overcome this difficulty, but when the ground is frozen water will stand on the surface, the grass will be killed out, and a growth of wild grasses and weeds often come in that it is almost impossible to eradicate.

The preliminary grading should be done as soon after the completion of the house as possible, that the land may become perfectly settled before sowing the grass-seed or setting the trees and shrubs.

Obtaining the Grade.

To obtain the desired smooth grade, flowing outline, and curve of surface, where the services of the skilled civil engineer is not available, various expedients are resorted to.

Many persons with a quick eye, trained to detect unevenness of surface or irregularity and unsymmetry of form, can obtain very good results without the aid of any instruments, but the majority will be obliged to call to their aid at least the carpenter's or mason's level and more or less small stakes. With this instrument resting on a box or

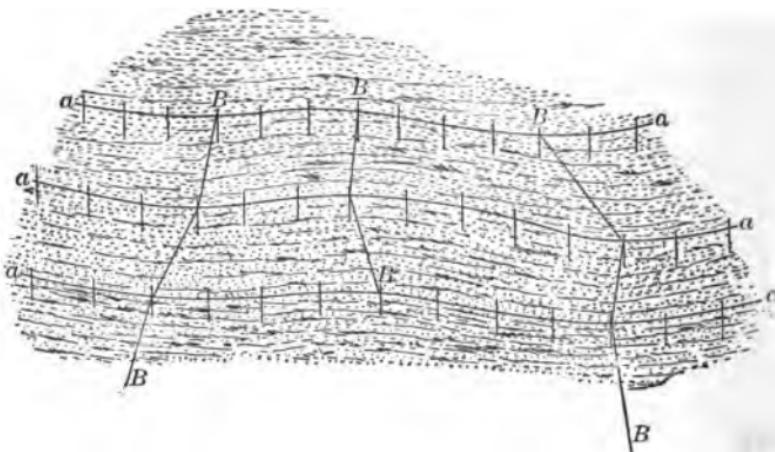


FIG. 8.—ILLUSTRATING METHODS OF OBTAINING GRADE.

block with a broad base, one may obtain the levels at important points on the ground, and then by stretching

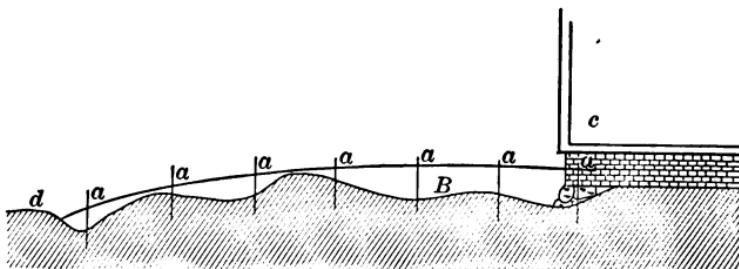


FIG. 9.—ILLUSTRATING METHODS OF OBTAINING GRADE.

strings from stake to stake, as shown in Figs. 8 and 9, easily judge of the comparative height of each point, and make

up the grade-lines and mark on the stake the necessary depth of fill or excavation to be made at each stake. In all this work the different grade-lines must be made to blend together so as to form a pleasing whole.

Where the land is rough and more or less covered with stones and stumps or the roots of large growing trees, much hand labor must be resorted to, spading and digging up the soil about the rocks, filling in with good soil where the surface-soil is poor and shallow, and rounding and smoothing up to the required grade. If the roots of living trees are near the surface, deep working must be avoided, but

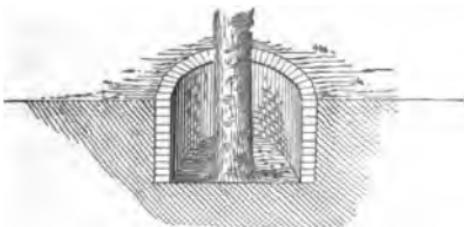


FIG. 10.—A “WELL” ABOUT TREE WITH ROOTS DEEPLY COVERED.

where feasible a covering of six to eight inches of good soil over these roots will often prove the cheapest way of making a good surface for the lawn. Deeper covering than this must be avoided, as it often results in the death of the trees. If it becomes necessary to cover deeper than the above, a “well” should be made about the trunk, as in Fig. 10, until the roots have had time to work to the surface. This well may be from 4 to 8 feet in diameter, according to the size of the tree and depth of covering. After two or three seasons of growth, when the roots have worked through the soil to the surface, this space may be filled in with safety.

If the covering of soil is over only a part of the roots of the tree, as in Fig. 11, the roots coming to the surface on

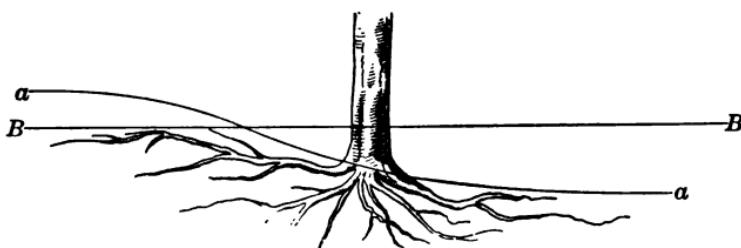


FIG. 11.—ILLUSTRATES COVERING THE ROOTS ONLY ON ONE SIDE.

one side, little injury need be feared unless there is a great depth of soil about the trunk, in which case the "well" should be made.

It is very difficult to make grass grow to great perfection under the shade of trees and where the tree-roots fill the ground, and the main dependence must be on surface-dressing with rich soil or compost and frequent seeding.

The Lawn.

Upon no one thing does so much depend in making beautiful home grounds as upon a good lawn, and after the buildings and the preliminary grading are completed come the smoothing up and preparation of the soil for the grass carpet or "*groundwork*" of the home-picture, without which no picture, whether on canvas or made of living plant-growths, is complete.

A good lawn cannot be made except on a rich soil, and if this is not the natural character of the land in hand the first thing to do is to make it rich and as deep as possible.

MANURING THE LAWN.

Where the land is free from stumps, stones, or other obstructions, a liberal dressing—from 10 to 15 cords per acre—of rich compost should be ploughed under as deep as possible. If the land is full of tree-roots and large rocks, this material must be spaded in or worked into the surface in some way. In addition to the above application 2 or 3 cords of well-decomposed fine compost, or from $\frac{1}{2}$ to 1 ton per acre of any of the standard lawn-mixtures, should be thoroughly worked in upon the surface. While commercial fertilizers alone often give good results, the effect of a heavy coating of stable manure is such as to make the land less subject to drouth. More failures in lawn-making come from a scanty supply of plant-food in the soil than from any other reason, and the poorer the soil the more liberal must be the supply of plant-food used.

MAKING THE SURFACE.

After the fertilizing-materials have been applied the land should be thoroughly worked and smoothed until a perfect seed-bed is obtained.

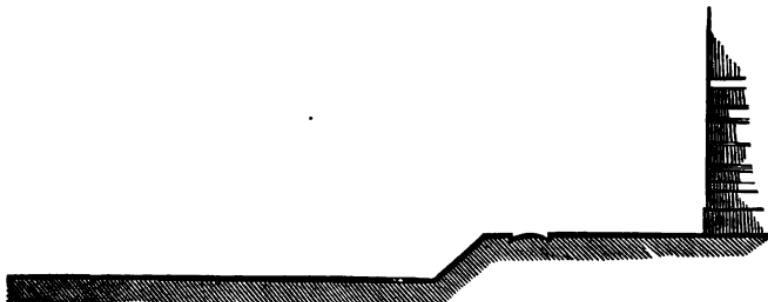


FIG. 12.—IMPROPER GRADING ABOUT DWELLING.

In grading away from buildings a perfect level should be avoided. Fig. 12 illustrates a very unnatural and unsatis-

factory grade, for the reason that the surface-water will not readily pass away, while the rounded surface that might be as well produced is much more natural and beautiful. If graded to a curved line running from the base of the building in this figure to the outer edge of the lot, much more pleasing results would be obtained.

The perfectly flat surface is scarcely ever found in nature except on the surface of water or boggy lowlands, and is very

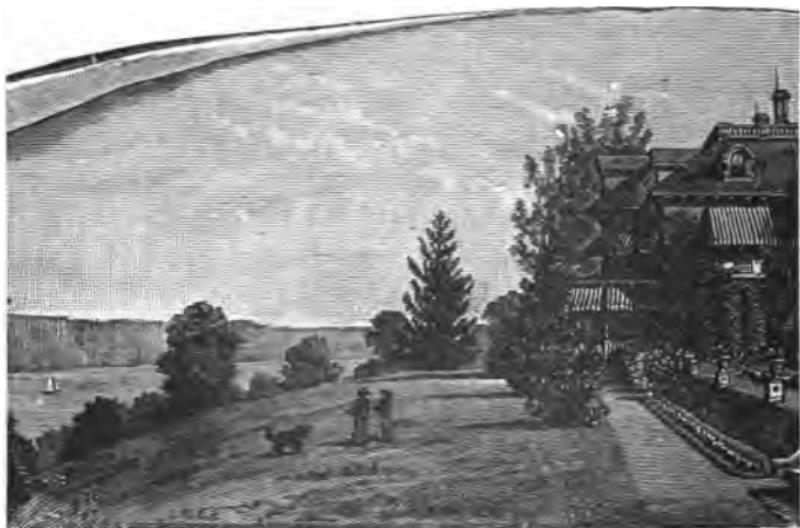


FIG. 13.—GRADING TO PLEASING OUTLINE.

difficult to ornament and keep in perfect condition. The terrace also in the middle of Fig. 12 is an unnatural feature, and hard to keep in perfect condition. In Fig. 13 is shown a well-graded surface with flowing outline. The effect of a level or flat surface is to give the impression of limited extent, while the rounded surface, as shown in Figs. 13 and 14, gives the impression of greater extent. The last figure illustrates a steeper grade than is shown by Fig. 12, but even with the same grade or slope

a much more pleasing effect is produced and the ground made much more susceptible to beautiful decoration.



FIG. 14.—GRADING TO CURVED SURFACE.

Figs. 15 and 16 still further illustrate the receding and rounded outlines desirable even if the grade be very great.



FIG. 15.—GRADING TO CURVED SURFACE.

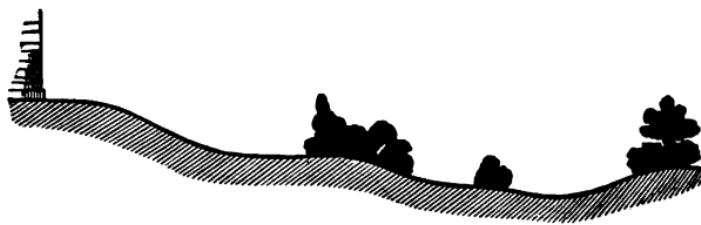


FIG. 16.—GRADING TO CURVED SURFACE.

In Fig. 16 greater variety of surface is produced, affording the appearance of much greater extent.

SETTLING THE SOIL.

To obtain a perfectly even, smooth surface, the land should be raked, then rolled, the depressions made by the

roller filled up, then raked again, and this work repeated until a satisfactory surface is obtained.

All trees and shrubs should, if possible, be planted before the grass-seed is sown. If planting cannot be done at this time, it should be delayed until the grass has become well established; otherwise the lawn will be very much cut up in the process of planting.

LAWN-GRASSES.

Only those grasses that make a fine spreading growth, i.e., tiller or spread by underground stems, give good results in lawn-making. The best kinds for general purposes are the bent-grasses (*Agrostis alba*, *A. vulgaris*, and *A. stolonifera*) and June-grass or Kentucky blue-grass (*Poa pratensis*), all of which spread rapidly by underground stems, that quickly fill up any vacant spaces between the grass-plants and thus prevent the growth of weeds. They also succeed on a greater variety of soils than almost any other varieties. On very light land and under shade of trees there might be added to the above the wire-grass (*Poa compressa*) and sheep-fescue (*Festuca ovina*) and its varieties, although the latter grows somewhat in tufts. White clover (*Trifolium repens*) is generally used in making a lawn, as it grows close to the ground and fills up all spaces not occupied by the grass-roots, thus preventing the growth of weeds. None of the coarser grasses, like timothy (*Phleum pratense*), orchard-grass (*Dactylis glomerata*), tall fescue (*Festuca elatior*), and rye-grass (*Lolium perenne*), have been found satisfactory by the author except where immediate effect is of more importance than a permanent and fine lawn.

TIME FOR SEEDING.

While the spring is the best time in which to seed a new lawn, it may be done at any time if the proper conditions of moisture can be obtained. A very large amount of manure or fertilizer and a moist condition of the soil will enable one to seed a lawn successfully at almost any time of the year, but these conditions are not so certainly secured at any other time as in the spring. In fall seeding, unless done very early, the young plantlets are likely to be thrown out by the frosts and a second seeding be required in the spring. Another reason why spring is better than summer for seeding is that weed-seeds do not grow so readily and abundantly at this time. Coarse stable manure should never be used upon the surface of the land, because it encourages the growth of weeds; but, if turned deeply under, nothing can be better to hold the moisture in the soil and encourage deep rooting of the grasses.

QUANTITY OF SEED REQUIRED.

The amount of seed to be used will depend somewhat upon the season when sown and the probable amount of weed-seeds that will germinate with the grass-seed. When sown in April, May, or September, less seed should be used than if sown in June, July, or August, and more seed will be needed when the land is full of weed-seeds than when it is comparatively free from such pests.

It is always best to use an abundance of seed, as there may be some uncertainty of its all germinating. Perhaps the quantity per acre that will give the best results under

the average conditions is 2 bu. of bent-grass, i.e., red-top or its varieties, 2 bu. of June-grass, and 10 lbs. of white clover. One half of this quantity would be sufficient if it all was certain to germinate and if no weed-seeds started into growth.

SOWING THE SEED.

After the land has been made perfectly smooth and fine by raking, rolling, and reraking the seed should be divided into two or more lots. The first lot is then sown in strips or lands, as evenly over the surface as is possible, and then raked in, taking care not to move the soil from place to place, thus bunching up the grass-seed with it. The second lot of seed is then sown in strips crossing the land in the opposite direction from the first sowing, thus securing the most even distribution of the seed possible.

A rake with long teeth set about 2 inches apart is better than the common iron-toothed garden-rake. If nothing better can be obtained, the common wooden hay-rake will be found to work well.

It is the general practice to roll the ground with the garden-roller after the seed is sown, but in extremely hot and dry weather, while the soil may be more thoroughly firmed about the seed by rolling, the smooth rolled surface leaves the young seedling so much exposed to the action of burning sun and drying winds that grass often does better if the surface is not rolled at all.

BORDERING WALKS AND DRIVES WITH TURF.

Before the seed is sown, if the edges of walks and drives are bordered with strips of fine turf on each side, much

after labor will be saved, for it is very difficult to trim up the edges of a newly seeded lawn without destroying much of the grass; and until the walk is completed and well settled there is more or less danger that the outline will be changed or edges defaced by passage over them.

LAWN MADE OF TURF.

Where fine, close turf composed of desirable grasses can be obtained, if the area is not very extensive, this may be the best way to establish a good lawn. It has the advantage that it may be done with perfect success during the hottest weather, or at any time when the ground can be worked. The land should be as carefully levelled up and settled as for seeding and be made equally rich if the best results are desired, though a turf may be formed in this way on very poor soil, but it will soon run out under such conditions. In laying the turf it should be very firmly pounded down and settled into the soft soil under it; otherwise it soon dries up in times of drouth. If turf is not abundant, it may be laid in strips one or two feet apart and the intervening space be seeded, when the roots from these strips will spread and a compact turf soon be formed over the whole ground.

Great care must be exercised on a newly seeded lawn that it is not cut up or disfigured by walking over it or allowing teams or animals on its surface. The lawn-mower should not be allowed upon it until the turf has become sufficiently firm to prevent the wheels from cutting in while turning the corners. The first two or three cuttings should be done with the hand-scythe or grass-hook.

CLIPPING THE LAWN.

Frequent clipping of the lawn, especially during the cool weather of spring and early fall, is necessary to make a fine close turf. The lawn-mower should be run at least once each week, and in case of very warm moist weather it may be necessary to run it twice or more. If the grass becomes so tall and heavy that the clippings do not settle down at once among the growing blades, it should be caught in the basket attached to the mower or be raked up and carried away; for if allowed to lie on the ground the roots under the close masses are often destroyed during hot moist weather, and weeds will be prompt to start in their place. The modern improvements in lawn-mowers leave but little to be desired in the line of perfection, but which of the many machines is the best is a question I shall not attempt to settle here. The horse-mower is a great labor-saving machine where large areas are to be cut, though it is not always possible to do as good work as is done by the hand-mowers, and the tracks made by the horse, unless lawn-shoes are worn, seriously disfigure a soft or newly made lawn. To enable the mower to run up close to shrubbery to cut the grass so that no hand-clipping need be done, we have practised taking out a circle of turf about one foot from the trunk of trees or the edge of a clump of shrubs. This enables the machine to take all of the grass clean and leaves nothing for the grass-hook to cut.

DRESSING AND RENEWING THE LAWN.

Frequent dressings of fine compost or special fertilizers in the fall or spring are necessary to keep any lawn in good

condition, and especially if on poor soil or under the shade of large trees, whose roots take up the plant-food in the soil with great rapidity.

Covering the lawn with coarse manure in the fall, to lie more or less exposed to view, is very objectionable and unnecessary, as a fine compost is equally effective in producing good growth and gives off no offensive odors. Quickly soluble fertilizer, like nitrate of soda, sulphate of ammonia, or muriate and sulphate of potash, may be used in limited quantities—from 200 to 500 lbs. per acre of a mixture of either of the nitrates with one form of potash, 1 part of the former to 3 of the latter, *on an established lawn*; but on a new one these salts cannot be safely used unless thoroughly mixed with the soil some time before seeding. Fine-ground bone, fine fish, and cotton-seed meal in place of the nitrates may be safely used under any conditions with no fear of injury to the roots or leaves of the young grasses.

Special lawn-fertilizers manufactured by nearly all of the large fertilizer-dealers are composed of materials well suited to make a rapid growth of lawn-grasses, but the same elements used in their unmixed condition will cost very much less and give equally good results.

The quickly soluble fertilizing-materials, i.e., salts of ammonia, soda, and potash, should be sown just as growth is beginning in the spring; while the less soluble, i.e., bone, fish, cotton-seed, etc., may be sown in the fall or during the winter.

RESEEDING THE LAWN.

Fertilizing-materials alone will not keep the lawn in perfect condition, but grass-seed should be frequently sown

objects, to *open vistas*, to *form backgrounds* for other ornamental materials, and also for their own individual beauty and the variety they afford in their varying shades of color and form. What beautiful shades and tints of color may be found in the foliage of different trees and in the same trees at different seasons of the year, and when skilfully arranged and blended together what beautiful pictures may be made with them.

Some of our trees produce beautiful flowers, others beautifully colored leaves; some take the spiry form, and others grow with well-rounded outline; some grow with a spreading or graceful habit, while others are close and massive in their build; some have thick and compact foliage, while others are provided with light and airy leaves;—and the true lover of nature will find much pleasure in the study of the numberless forms and varieties, and especially in arranging them so as to obtain the most real beauty possible.

A Plan.

Before any planting is done a plan of arrangement must be decided upon. As with plans for dwellings, much good work can be and is done by amateurs in making plans for ornamental planting, but unless one has made considerable study of the materials to be used and the results to be obtained by their combination, and has investigated all of the points as to the special requirements of soil, planting, training, etc., of each species or variety, the advice of an expert should be sought.

While in making plans for the arrangement of ornamental trees, shrubs, etc., the money paid to a skilled landscape-gardener for a detailed plan often saves many times this

amount, I would not discourage the study of the landscape art by advising every one to have a plan made by a trained landscape engineer; for the more general the knowledge among our people there can be upon any subject the better it will be for the whole community, while the *monopoly* of any line of education or knowledge by the few is a crime and an injury to the people as a whole; and many an amateur has been able to produce results that have not been reached by members of the profession.

The details of the plan of arrangement and what trees to use and how many must be largely settled by the requirements of the place to be decorated and the conditions and tastes of the owner. On grounds of considerable extent with an abundance of space large broad spreading trees in considerable variety can be used, while in the village lot few, if any, large trees are desirable. Yet under some conditions a single large tree not far from the dwelling, even on a small lot, may be productive of much comfort and pleasure, and, while very little variety may be obtained, the effect is often one of beauty.

Improving Established Trees.

In Chapter VII brief reference is made to the treatment of trees already on the grounds. These, if large, should be very carefully considered, and not a single healthy tree be destroyed unless for a positively good reason; for the most quickly growing trees that we have will not reach the size to afford much shade until they are fifteen to twenty years of age, and if what we have already growing are not quite what we wish we may preserve them until such a time as other and more desirable trees have grown up to take their place.

The condition of these trees often, especially where they have grown closely together, is generally such that severe trimming and some training may be necessary to bring them up to their most beautiful and perfect condition; but trees with sound trunks and good roots in good soil even though large and ill-shaped may be made ornamental. Figs. 17,

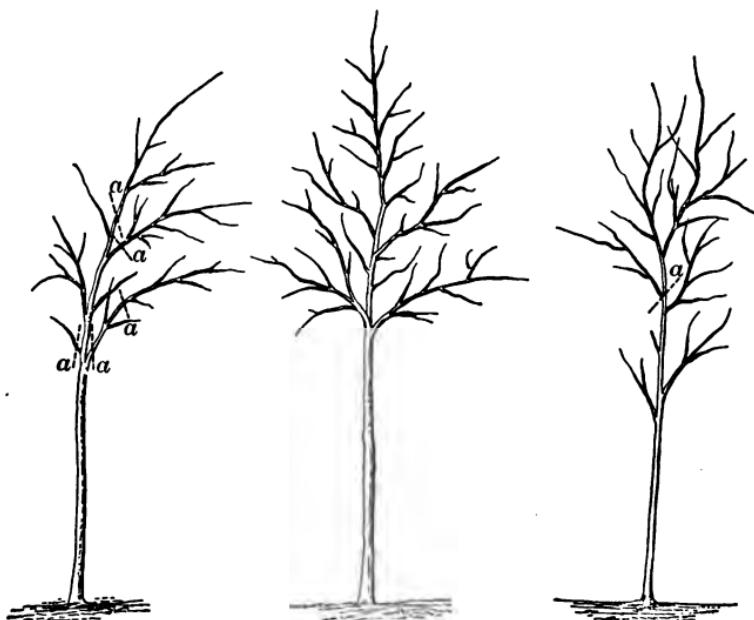


FIG. 17.

FIG. 18.

FIG. 19.

19, 20, and 21 illustrate trees as they are often found, and the dotted lines *a* show where they should be cut or headed back to give them the proper start to renew their growth. Fig. 19 shows a very tall tree with branches and leaves so far from the ground that when the foliage is covered with moisture or the shoots with ice or snow it may be injured by bending to the ground; when if cut as shown at *a* to the height desired and a leader encouraged to form the centre of the growth, with laterals

at intervals of from six to ten inches apart, as perfect a tree will be formed as if grown from seed or obtained from the



FIG. 20.



FIG. 21.

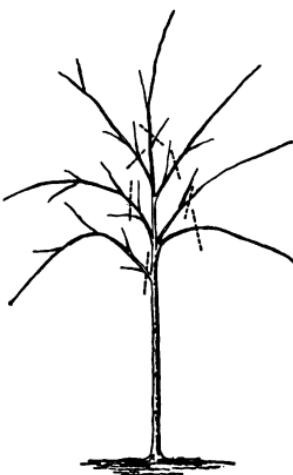


FIG. 22.

FIGS. 20-22.—TREES AS OFTEN FOUND ON BUILDING-LOTS.

nursery (see Fig. 18). When cut off in this way, the branches should not be allowed to grow in a cluster at the top, as in Fig. 24, thus forming a fork which is sure, sooner or later, to break down from weight of foliage, crowding of branches, or ice and snow. Many trees grow up with forked branches not very far from the ground, as shown in Figs. 20 and 21, which when they reach large size will split down and thus ruin the whole tree. In this case the smaller of the two forked branches should be cut away at line *a*, the head be cut back if needed, and a perfectly formed tree will be the result. This fork is sometimes near the ground and the sooner one of the trunks is cut away the better. In Fig. 17 is shown a one-sided tree, which may

be put into condition to make a good form by cutting off the branches at the lines *a*, when with full exposure to air and sunlight it will take an upright symmetrical growth.



FIG. 23.

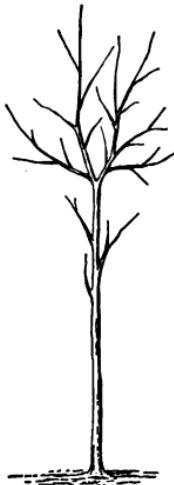


FIG. 24.

FIG. 23.—LINES FOR THE PROPER TRIMMING OF ORNAMENTAL TREES.

FIG. 24.—CLUSTERED GROWTH OF BRANCHES.

Pruning Old Trees.

Fig. 25 illustrates an old tree which has been severely pruned. Before pruning, long straggling branches were exposed to the hot sun and drying winds and the sap so retarded that very little new growth could be made. If these branches be headed back as shown in the figure, a new growth will soon be sent out, the trunk and branches soon be clothed and protected, and the form much improved. The best instance of the success of this kind of pruning to which I can call the reader's attention

may be seen at the Arnold Arboretum at Jamaica Plains, Mass., where, under the skilful management of Prof. C. S. Sargent and Jackson Dawson, the large, more or less



FIG. 25.—AN OLD TREE HEADED BACK.

unsymmetrical forest trees upon the grounds when the planting of other trees began have become most beautiful and symmetrical trees.

Covering Wounds.

Whenever large branches are cut off or wounds are made upon the trunk or branches, the injured part should be thickly covered over with gas-tar or linseed-oil paint. This will prevent very rapid decay of the wood, and when grown over the injured parts will remain comparatively sound for many years.

Selection of Varieties.

In the selection of varieties the inexperienced especially must give the matter very careful consideration. Dependence cannot be placed on the often exaggerated descriptions found in the average nurseryman's catalogue. Especially is this true of new varieties, for *no one* can tell just how they will do under differing conditions and what insects or diseases may be found to destroy them as they grow toward maturity; and nothing should be planted, in the main features of the place at least, which has not been fully tested under many varying conditions. New and untried things should, if planted at all, be put where they may be replaced, should they fail, without injury to the main features of the grounds.

With the large numbers of parks, arboreta, and extensive planting on large estates, and especially the experimentations in all of our States, any one can learn what are desirable trees and shrubs for any given locality, and there is no need for taking any risk in planting ornamental grounds with untried varieties.

In selecting the varieties best adapted to one's own locality a few visits to some of the above-mentioned places, a careful inspection of such as may be found growing in the vicinity, and a study of their adaptability to the various kinds of soil will enable one to make a satisfactory selection.

Size of Trees.

The size to which different kinds of trees will grow must be fully understood, although this will vary very much with the condition of the soil in which they are planted.

While young they occupy but little space, and the desire to have enough planted to give immediate effect often leads to too close planting. The larger the space to be decorated the more and larger trees may be used and the greater variety obtained.

The reader is again urged to study carefully the descriptions given in Chapter X.

Distance for Planting.

Specimen trees should never be planted so closely that they will touch, even when fully grown; but if grouped for the formation of a grove, for dense shade, close planting is advisable, and the more closely planted the taller will they grow and the fewer will be the lower branches.

While of small size it may be well to plant closely for immediate effect, removing the least desirable specimens *before they touch so as to injure the more valuable.*

For avenues, for shade of walks and drives, the distance should be such as to give full development and yet give the desired shade.

If the walk or roadway-space is narrow, the distance lengthwise may be much greater than across the space, as in Fig. 26. For the large-growing trees, like the elm and oak, 50 feet is about the best distance for roadside shade, and for the maples, poplars, tulip-tree, etc., not less than 30 to 40 feet. If shade is desired more quickly than can be obtained by full growth, the trees may be set out at half the above distances, and then when they come together so as to endanger the beauty of all every other one may be cut out. The great danger of this practice, however, is that we are liable to neglect the desired thinning out until

too late. If this close planting is practised, it must be borne in mind that two or more trees planted on a given space will require more plant-food and more care than one, but, on the other hand, in very exposed places one may serve

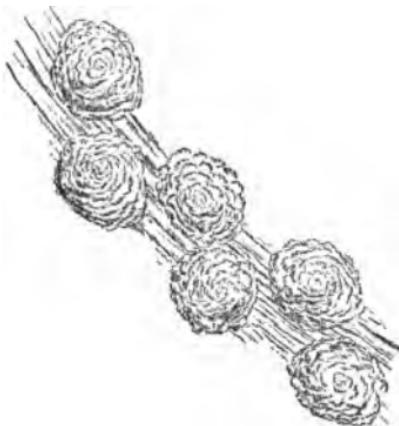


FIG. 26.—ARRANGEMENT OF TREES ON NARROW STREETS, DRIVES, OR WALKS.

more or less as a shelter for the others, and thus a better growth be obtained than if but one were planted.

Where to Obtain Trees.

With the large number of good nurseries in the country no one need find any difficulty in obtaining good trees for planting. Other things being equal, the nearer home the trees are obtained the better, as there is a great deal of risk to run in buying trees from distant nurseries on account of the danger from injury by delay in transportation.

If one is skilled in caring for trees in the nursery, small seedlings or grafted trees may be obtained a few years before they are needed, and when ready for planting they will be in the most perfect condition for successful growth, as they

may be dug one at a time and be planted with the least possible exposure to the air. The work of planting also can then be done at the proper time.

Much pleasure may be derived from this work in watching the growth of the young trees started from seed or very young grafted stock, and in training them into proper forms. Good trees of the elm, maple, and other deciduous trees, and some of the evergreens, may often be dug from pastures and roadsides with success and if properly treated will make a satisfactory growth. The oaks, hickories, and others having a long tap-root and few fibres need to be dug around one or two seasons before transplanting, cutting a trench 2 feet deep and a foot wide and filling it in with good soil. This will cause fine roots to grow and then the trees can be successfully transplanted.

Time for Planting.

In light land not too much exposed to drying winds and in climates where the growth of the trees matures early the early fall is the best time to transplant most of our deciduous trees, but in places much exposed to sweeping winds or in heavy soils much injury is often done to fall-set trees by this exposure.

Except under the above favorable conditions spring is by far the most favorable season for transplanting. This work should be done as early as possible, but not until the soil will work up fine and mellow.

If possible, the trees should be on the ground ready for transplanting at the earliest possible moment, and if ordered from distant nurseries the order should be sent in in time for prompt and early shipment. If the orders are sent

during the rush of shipment, there are many chances for delays, and more injury will result from delay at this time than if shipped early in the season. If purchased in the fall and carefully heeled in in rather light, well-drained soil, a considerable part of the trunk covered with soil, and the tops protected by pine boughs or some other light airy covering, they will keep in perfect condition and be ready for planting at the earliest possible moment in the spring.

Evergreens may be transplanted with success at any time of the year from April to December, when the ground will work up fine and mellow, *if the weather is moist and soil not very dry*; but in July and August there is often danger from drouth, and in November the ground often freezes up before the soil has become fully settled about the roots, therefore these months are not so desirable for transplanting as April, May and June. For transplanting evergreens a moist day, just after an abundant rain, gives the most perfect conditions. Perhaps the most favorable conditions for transplanting evergreens will be found in the months of May and June.

Preparation of the Soil.

Without a good soil properly prepared no one should expect to make newly transplanted trees grow satisfactorily. If the land is smooth and free from rocks, the subsoiling and manuring done when fitting the land for the lawn will be sufficient for a good growth of the trees, but if it has not been worked in this way special preparation must be given the soil for the roots of each tree. In a naturally rich soil, if the subsoil is worked up and partly replaced by the surface-soil, and good enriched soil be worked in around the roots, a vigorous growth may be expected; but if the

soil be poor, some fine compost must be put in around them.

Unfermented manures in large quantities, or fertilizers containing the salts of potash or soda, should *never be placed in contact with the roots*, but, if used at all, should be spread on and worked into the surface-soil.

The space to be prepared for the roots of each tree should be considerably larger than the spread of the roots, varying the size according to the soil; the poorer the soil the larger should be the space that is worked up.

Digging Trees for Transplanting.

More trees die from injury received in digging than from any other cause, and the greatest care must be exercised in this work, as so much of the success in transplanting depends upon how well the work is done. Without a good root system, no matter how favorable the other conditions are, there can be but little growth.

In digging the trees the first thing to be done is to remove the surface-soil down to the roots and then to cut a trench around the tree at a distance of from 1 to 4 feet, according to its size. With young trees, or those that have been transplanted once or more, cutting down with a sharp spade in a circle around the trunk will be all that is necessary, when, with the aid of a strong spade on each side and a strong man to pull, the tree may be loosened from the soil with a good supply of roots. If the trees be large, the soil must be removed from the trench to the depth of the lowest roots, which will be from one to two feet, and the roots be then loosened and freed from the soil, until the ball can be lifted from the hole or raised upon planks to be

mounted on a stone-boat or low truck for moving it to the place of transplanting.

Sometimes this moving can be done best in the winter, the trench about the tree being dug in the fall and the ball allowed to freeze, when it can be more easily handled. But if proper care is exercised no difficulty need be experienced in moving large trees either in the fall or spring. Trees with trunks a foot or more in diameter may be moved if an excavation is made under the root system and a large ball of earth is taken up with the roots. To move such trees requires great expense, and appliances of screws and lifting-apparatus for raising and moving many tons of soil.

Pruning Trees for Transplanting.

No matter how carefully a tree may be dug many of the roots will be injured, and with trees that have been dug several weeks, as they often are when purchased from a considerable distance, nearly all of the feeding-roots are destroyed, and can supply but a small amount of sap to replace the moisture that evaporates from the large number of branches and buds, so that growth starts very slowly or the trees fail entirely. By removing the branches and buds in proportion to the injury of the roots a balance is created. Considerable heading in of the top should be done even if there are but few roots injured and only a small surface of branches and buds to be supplied with sap, for there will be a much better chance of the remaining buds starting, and they will grow with greater vigor than if no pruning were done. After a few strong active leaves have been grown vigorous new cells will be formed rapidly, instead of the weak sickly growth of the unpruned tree.

Figs. 22 and 23 illustrate trees properly pruned for planting, the dotted lines showing where the cuts should be made.

Pruning too at the time of transplanting is often necessary in order to start the branches at the desired height. If low-branching trees are desired, it is often necessary to head them in severely from the top, as in Fig. 19. This is especially the case with trees taken from swamps, pastures, and roadsides. If all the branches are cut off to a "bean-pole" condition, as is often done with very tall and top-heavy trees, much care must be exercised that the branches do not all come out nearly at one point, as in Fig. 24. A leader should always be started, as shown in Figs. 18 and 23, and the laterals must grow slowly and at considerable distance apart to prevent the formation of forks that will split down when the trees are heavily loaded with snow or ice. The height at which the main branches shall be started depends upon the surrounding conditions. For covering avenues or walks a height that will clear the heads of pedestrians when the branches are weighted with rain or snow is sufficient; and for a drive a height that will clear any carriage or loaded team that may be driven under them is sufficiently high, unless it is desirable to get views or vistas under the branches through to pleasing objects.

With trees from the nursery less pruning is needed than if taken from the woods or roadside, as their root system is generally more compact, owing to transplanting and cultivation; but it will be better to prune as much as is necessary to start the tree in proper shape, cutting out all shoots not in proper position to form the head, and shortening in all of the permanent shoots, always preserving and en-

couraging a leader whether the tree be naturally a round or conical-formed one; but this applies more especially to all avenue trees, which should be kept growing most vigorously at the centre. In Figs. 22 and 23 the dotted lines illustrate where the cuts should be made. All ends of roots that are cut off or injured in digging should be pared with a sharp knife to facilitate the formation of new roots, and when large branches are cut off the wounds should be painted over with some waterproof covering, like shellac, grafting-wax, or linseed-oil paint, to prevent decay.

Evergreen trees are not generally pruned much at transplanting, but they will be benefited by some shortening in of the end branches, cutting out all but one leader, and removing any branches that are not needed to produce a symmetrical form.

Planting the Tree.

No matter how well the soil may be prepared, how fresh the trees may be when received, or how well they may have been prepared for planting, if the work of planting is not properly done, they may fail to grow at all or grow so poorly as to give little satisfaction.

Many failures in tree-planting result from the slovenly and imperfect way in which the work is done, and the nurserymen are too often blamed for the failures.

In planting, the roots of all trees should have a fine mellow bed of good soil, which should be pressed firmly into contact with every fibre, leaving no air-spaces around any of them, and every one should be spread out in a natural position and so that no two shall touch each other. Immediately in contact with these roots good soil should be

very firmly pressed, so that new roots will be encouraged to start out at the earliest possible moment.

The late Peter Henderson, than whom there have been few, if any, more successful growers of all kinds of plants and trees, tells a story in one of his catalogues illustrating the benefit from the firm pressure of the soil about the roots. "A lady to whom he had sold some roses wrote to him about the condition of her plants after she had spent much time in planting and caring for them, stating that only one out of a dozen had lived, and that one her husband, who weighed 240 lbs., had accidentally stepped upon soon after planting." It is also sometimes said that the "heaviest man or the one with the largest feet is the best man to plant trees."

Too much pressure may be given to the soil above the roots in planting, but generally the error is in the opposite direction. To crowd the soil under and around the roots and press it firmly, a pointed stick is often better than the foot.

In planting, the tree is placed in the hole at the same depth it grew in the nursery if the soil is of the same character, a little deeper if it is lighter, and perhaps a little nearer the surface if heavier, and after carefully spreading out the roots it is ready for the covering. Only fine, moderately rich soil should be used for filling in around the roots, and this should be carefully worked into place with the hands and firmly pressed, until all the roots are covered two or three inches deep, when the work may be completed by treading down and tamping, taking care that the bark of the roots is not injured in the process.

After the fine soil to the depth of three or four inches is firmly pressed in place that remaining is thrown loosely on top and *not trodden* at all, thus serving as a mulch.

When the soil is compacted on the surface, it is in condition to rapidly carry off the moisture, but if it is light and mellow its capillary condition is broken up and the moisture cannot escape.

Watering at Planting.

If the soil is fairly moist and firmly pressed about the roots, there is no need of applying water to the roots of trees at planting; but if in a very dry state, water may be used in the hole before setting the tree, filling it up several times, and after it settles away put the tree in place. Another very good way of watering in a very dry time is, after the roots have been covered with three or four inches of soil, if water is filled in two or three times and be allowed to settle away, and then the surface-soil be filled in light and loose, better results will be obtained with a few pailfuls of water than if large quantities is used on the surface after the tree is planted. Little benefit can result from the application of water to the surface after planting unless a large quantity is used, so as to saturate the soil down to the roots, for the diffusion of water through the soil when applied to the surface is so slow that it will take a long time to obtain this result; besides, this surface-watering compacts the soil so that after it is done the moisture escapes more rapidly than before. This evaporation after watering may in a measure be prevented, however, if the surface-soil is stirred up with a fine rake two or three inches deep, the fine soil serving as a mulch.

Mulching.

Many newly planted trees start into growth in the early summer and then from lack of moisture fail to grow.

Where water is not available a mulch of some coarse organic matter, like straw, meadow hay, corn-stalks, fine brush, weeds, or even planing-machine shavings or spent tan-bark, covering a little larger area than the size of the hole in which the tree was set, will aid in keeping the moisture from escaping. This should not be put on more than two or three inches in thickness, for if too thick it causes the roots to grow near the surface, when they would be liable to injury during the winter or in extreme dry weather.

Keeping up an After-growth.

When the trees are planted, it must not be expected that the end of one's work has come, for unless the soil is naturally very rich or is made so by heavy manuring trees will not continue to grow without some additional plant food each year. When planted on the lawn, if the grass is clipped once or twice each week and liberally dressed in the fall or spring, little or no further fertilizing for the trees may be needed; but even under this condition a mound of manure banked against the trunks before the ground freezes in the fall will be of great protection to the collar or crown of the roots. This method of manuring trees in poor soil is advisable, a liberal supply being used, and in the spring spreading it around on the lawn about the trees. Commercial fertilizers, like ground bone and potash, fish and potash, or even the specially prepared fruit-tree fertilizers, may be successfully used.

The Arrangement of Trees.

Trees are arranged or grouped together in ornamental gardening to accomplish the following results: for shelter

from cold winds, for screens to shut out objectionable views, and in groups alone or combined with shrubs for ornamental effect or to serve as a background for or setting to the house, thus completing or finishing the home-picture.

TREES FOR SHELTER.

Scarcely a location can be selected where there is not some point that needs protection or shelter from prevailing winds or from storms, and generally only those trees that are very hardy and provided with an abundance of thick tough foliage should be used. They are more commonly planted on the north or west exposure, and should be set as closely as possible and have them grow to a good degree of perfection. If immediate shelter is needed, close planting may be advisable, but the surplus trees should be removed as soon as they begin to interfere with the perfection of those desired for permanent growth. It is always best to plant those that are the most desirable for permanent growth at the proper distance for full development, and then arrange the more temporary kinds so that they may be finally cut out. In this work, as in all grouping of trees and shrubs, it is best to obtain as much contrast and variety of form and color as possible, and yet have a pleasant blending of all the characteristic features.

Evergreens are generally planted for purposes of shelter, as they hold their foliage during the winter, though a mixture of deciduous and evergreen trees will give the most satisfactory picture. The evergreens, especially when massed, produce a sombre effect, which is lightened and relieved by the introduction of some deciduous trees, like the birches, golden willows, etc.

The larger and more stately trees should be set at the

border of a corner group, or, as in Fig. 27, in the centre of isolated groups, the smaller or more graceful and ornamental kinds being grouped about them, and if possible so

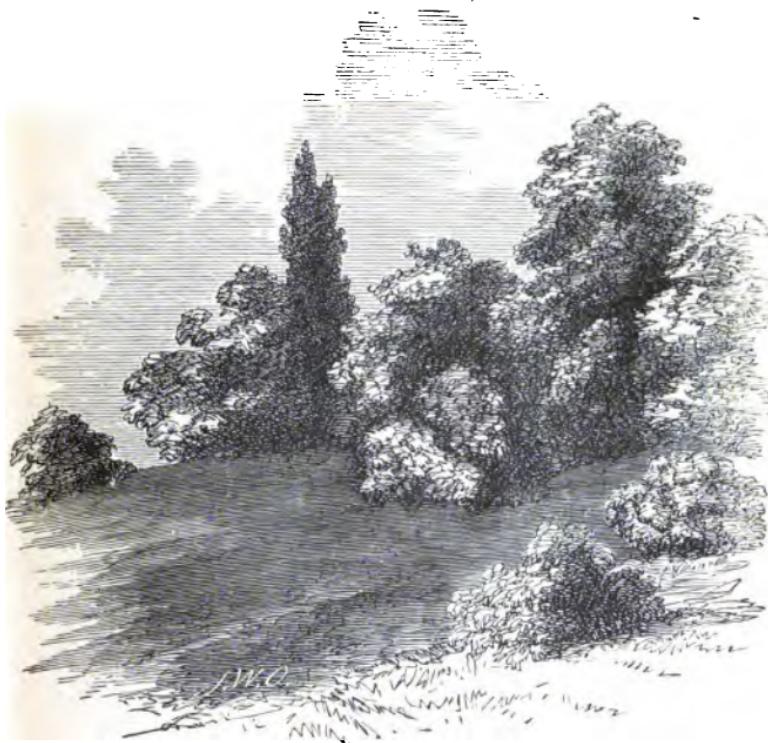


FIG. 27.—LARGE-GROWING TREES ARRANGED IN CENTRE OF GROUPS.

that there may be a gradual diminution in size at all points of view from the centre to outside of the group.

The size of the trees to be used must vary with the extent of the grounds on which they are planted and the height of the desired shelter. On very small lots a single large tree with a few smaller ones grouped around it will afford much shelter.

TREES FOR SCREENS.

The useful and ornamental may be combined with good effect in grouping trees for screens, i.e., to cut off objectionable views or to enhance the beauty of desirable ones. The same rules should be observed in their arrangement as in planting for shelter. The effects to be obtained in this kind of grouping are many. Unsightly objects viewed from the house may be covered or hidden from view, as well as objects on the grounds that it is desired to screen from the house or from public view, as the clothes-yard, stable and other outbuildings, etc. The quiet retreat where one may be away from the public gaze is a feature to be desired in every more or less thickly settled community, but the great mistake often made of planting a close hedge or screen around the entire grounds, shutting off all view from both inside and outside, should be avoided.

The ornamental features of our grounds should be made with the view of adding as much of beauty and comfort to them as possible, and if we succeed in creating anything of beauty or comfort others are entitled to share it with us to the extent at least of looking upon its beauty.

Grouping for Ornamentation.

When neither shelter nor screens are needed, ornamental trees are planted as a setting to the buildings or for the decoration of the grounds, and in this work much knowledge of the various forms, colorings, and distinctively characteristic features of trees is needed. The more one studies trees and shrubs and their artistic grouping the greater will be his success.

But in this grouping the effect both of shelter or screens and of beauty may be obtained by careful study of materials and their skilful arrangement.

NATURE AS A GUIDE.

In nature we sometimes find most beautiful illustrations of the grouping of trees, on knolls, in the shady dell or open field, and much may be learned by following this most versatile teacher. In many cases, however, art can improve upon nature. We can improve upon most of the effects we find about us by providing the best possible conditions of soil and surroundings for the development of each specimen. We can collect from all quarters of the globe the most beautiful of her treasures, and make each specimen of a group grow to its greatest perfection, which seldom occurs in nature's grouping. We can create nothing, but we can use all of nature's blessings so that beauty and good may be the result.

TOO CLOSE PLANTING.

One of the greatest mistakes made in grouping ornamental trees is too close planting, as has been suggested on a previous page, and unless immediate results are desired each specimen should be given space sufficient for its full development. In this work as much variety is desirable as it is possible to obtain and at the same time secure harmony of forms and colors. (Fig. 55.)

RULES FOR GROUPING.

1. Groups of trees of similar characteristics should generally be avoided unless the place is of large extent. If

we plant all conical trees, like the spruces, larch, Lombardy poplar, fastigate oak, etc., all low-growing spreading trees, all trees with yellow foliage or those with purple foliage, by themselves, we do not get as pleasing results as if a variety of forms, colors, and sizes are used and are arranged in a natural and artistic manner. In Fig. 27 we have a very pleasing arrangement of large and small trees and shrubs, as well as a pleasing blending of forms, each placed so as to bring out the peculiar features and all producing a pleasant picture. In Fig. 31 is illustrated the grouping of trees and shrubs along the borders of a walk or a curved roadway, in which vistas are left open. The larger and heavier trees are grouped in the centre and the smaller ones around them.

2. As in the arrangement for shelter or screens, so in the ornamental groups the tallest trees and those most spiry will be more pleasing if grouped in the centre or background, with the lower, more rounded or graceful kinds placed in order of size, keeping in mind, of course, variety and contrast, and yet securing harmony of colors as much as possible. Trees with very heavy or dark foliage should not be planted by the side of those with light, feathery or very fine foliage, but something of an intermediate tone should be introduced between them. So a very small tree should not be planted close up to one of large size if its branches are carried high, but if the branches come to the ground with a broad slope, as in Fig. 27, both a distant and close planting will be pleasing.

3. The trees having the greatest individual beauty should be put in such position that their beauty will be enhanced by having a good background or a good setting. Thus the appearance of a purple-leaved beech will be improved if planted in front of or in the angle formed by silver maples

and golden poplars. The foliage of trees like the golden poplar, maple, or elm will be injured in effect if planted in contrast with trees of a bluish or very glaucous color, while trees with showy flowers will be made more conspicuous if planted with a mass of dark-colored foliage for a background.

4. Specimen trees, i.e., those that stand out on the lawn conspicuously, should be those of characteristic beauty. The oak has the characteristic beauty of strength; the elm that of graceful, arching form; the purple beech, Nordmann's fir, and the Colorado blue spruce great beauty of coloring; the cut-leaved weeping birch and Japanese weeping cherry the beauty of graceful, flowing outline; and each and all of the more common ornamental trees have some characteristic beauty which it should be the study of the landscape artist to bring out in grouping them together.

5. Groups should not be planted so as to present a too solid appearance, and if arranged so as to give each specimen its proper distance and setting there will be little danger of this result. To still further lighten up a group that has a tendency to too much compactness, small isolated specimens in the lawn at a little distance from the outside tree may be planted, as shown in Figs. 27 and 28.

6. Where the surface of the lawn is rolling, instead of arranging the trees, as in Fig. 29, much better effect will be produced by dividing the group, as shown in Fig. 30. In this way a much smaller number of trees will give more real beauty to the grounds than if all were planted in a line or a close group.

7. When planting along walks or drives, an effort should be made to group as naturally as possible and, if the curve of the walk or drive is made to extend around and

beyond what seems to be the natural and direct line of travel, to so place the trees or shrubs as to overcome the

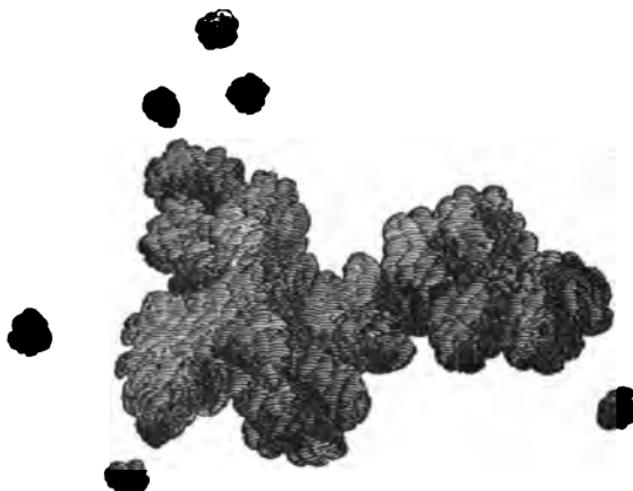


FIG. 28.—SMALL TREES OR SHRUBS ON BORDER OF GROUPS.



FIG. 29.—TREES SET IN TOO FORMAL MANNER.



FIG. 30.—TREES SET IN NATURAL GROUPS.

feeling that a greater distance is being travelled to go from one place to another than is necessary. A very good idea of this grouping is shown in Figs. 31 and 32.

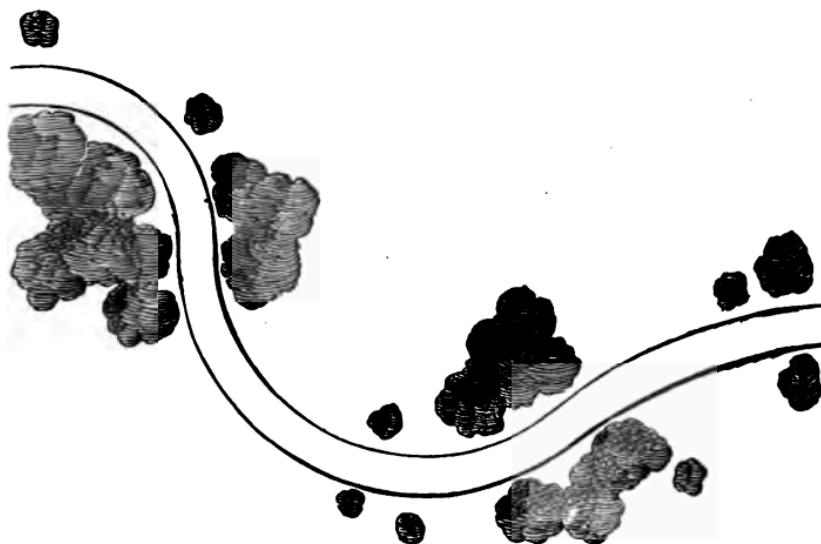


FIG. 31.—TREES AND SHRUBS GROUPED ALONG WALKS AND DRIVES.

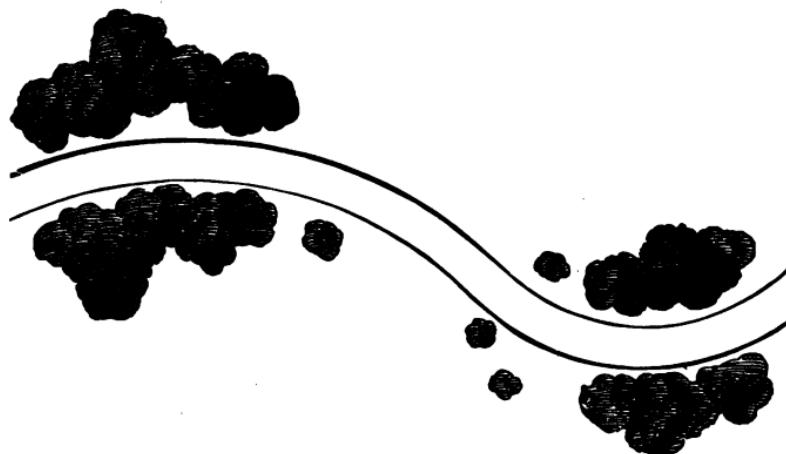


FIG. 32.—TREES AND SHRUBS GROUPED ALONG WALKS AND DRIVES.

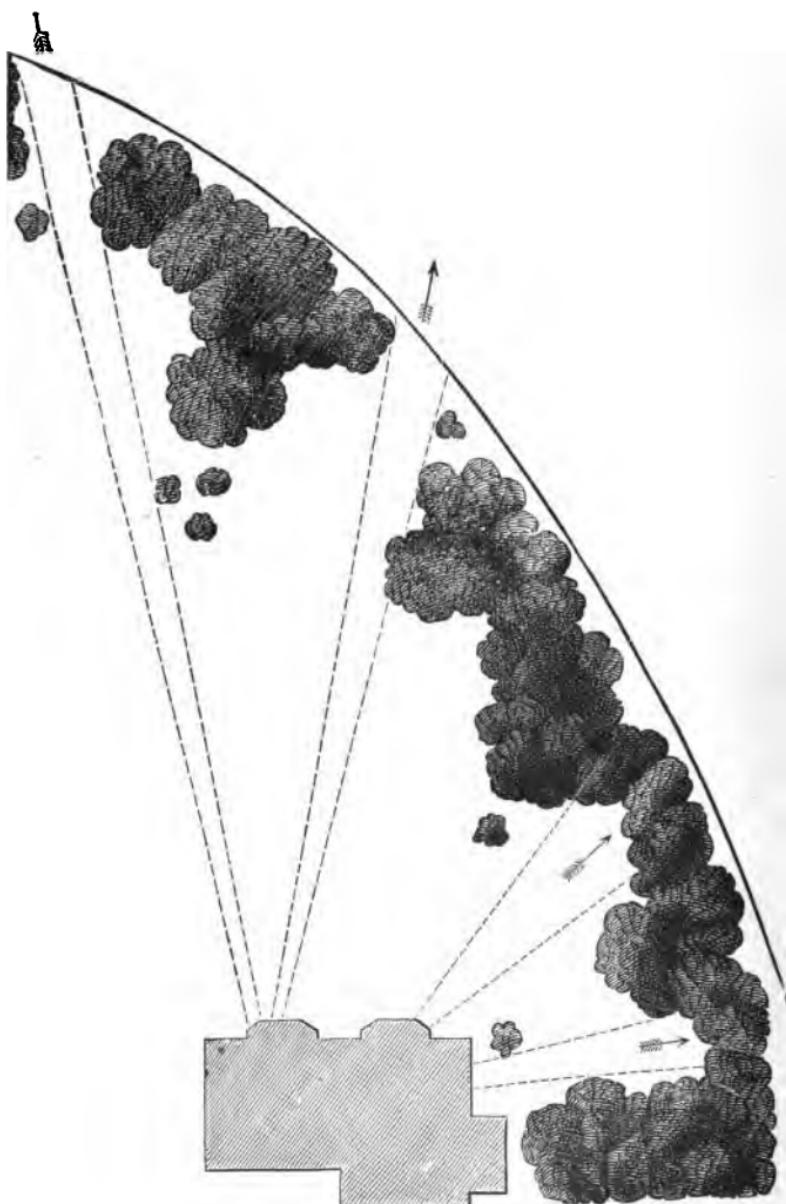


FIG. 38.—TREES AND SHRUBS PLANTED ALONG RADIATING LINES TO AFFORD VISTAS.

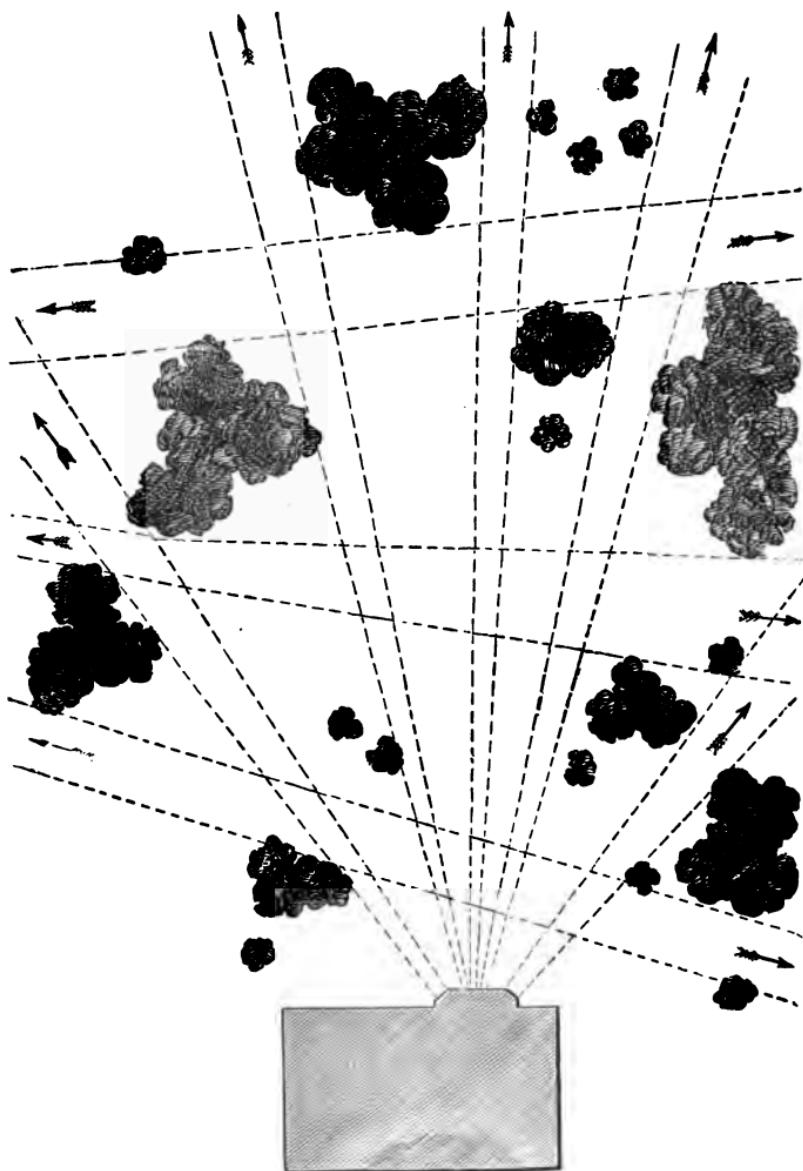


FIG. 34.—TREES AND SHRUBS PLANTED ALONG MANY RADIATING LINES TO AFFORD VISTAS IN MANY DIRECTIONS.

8. Vistas or openings should be provided wherever interesting objects or views are presented, and the arrangement of trees and shrubs be in radiating lines, as shown in Figs. 33 and 34. In this manner vistas or pleasing views may be arranged from the prominent points of the house, as from the verandas, bay windows, or piazzas, from various points on the lawn, and the planting may be so made that the pleasing features of the grounds may be enjoyed by those outside. Considerable skill will be required sometimes to afford a screen at certain points from an intrusive public, to open views to others, and at the same time to secure the best of the outside beauty to the occupants of the house. Very pretty views or vistas are shown in Fig. 13 and in the frontispiece, at the left in both pictures.

9. If the groups are planted near the house, trees or shrubs of small size will often cut off objectionable views which would require much larger specimens if planted at greater distance, as shown in Fig. 35. In case of large trees

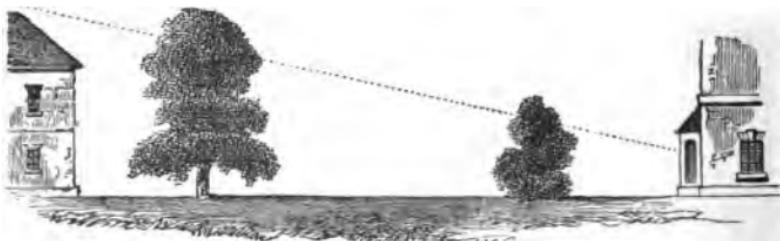


FIG. 35.—EFFECT OF SCREEN TREES AT DIFFERENT DISTANCES FROM HOUSE.

near the dwelling vistas may be obtained from under the branches, and a tree well headed up gives an abundance of shade and at the same time a good circulation of air, which are very desirable during the hot summer months.

10. The beauty and comfort obtained in all this work of

grouping depends very largely upon how carefully every point suggested above is studied and viewed from all sides, and how fully the planter understands the height which each of the species planted will attain under different conditions of soil, exposure, etc.; for while the trees are young the vistas and covering may be just right, it may take but a few feet of growth at one side or above the group often to hide from view some of the most beautiful features of the place.

11. Groups of trees are generally in good taste planted on both sides of a walk or drive at the entrance from the street, Fig. 36. Arranged in this way they serve to mark

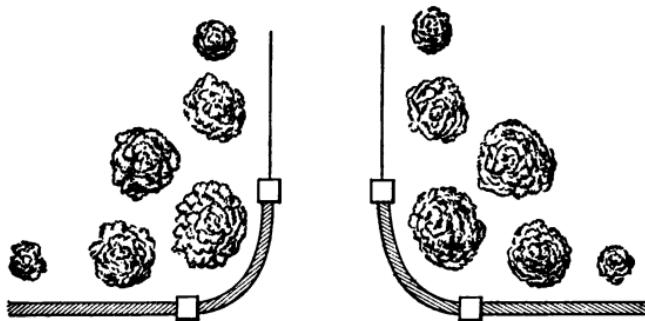


FIG. 36.—TREES AND SHRUBS GROUPED AT GATEWAY OR OPENING OF WALK OR DRIVE.

the exit or entrance in a definite way when seen from a distance or during the night-time.

12. Corners or abrupt angles in the boundary-line may be filled up with trees and shrubs so as to present a most pleasing effect, not secured if these features are left without decorations.

13. In nature we often find most beautiful groups of trees on the tops of rounded surfaces which we may well copy in this particular where such features of surface are found. This point is shown in Figs. 37 and 38, and if, as in these



FIG. 37.—TREES AND SHRUBS GROUPED AT CROWN OF ROUNDED SURFACES.



FIG. 38.—TREES AND SHRUBS GROUPED ON A ROUNDED SURFACE.

illustrations, some picturesque or strikingly beautiful tree is planted in the group it is sure to attract attention.

14. To cover up or to break the monotony of a straight

line of trees, a hedge, or a bank wall, trees and shrubs may be grouped in a more or less irregular yet artistic manner some distance away with very pleasing effect.

15. In the grouping of trees and shrubs there should be an effort made to obtain vistas of as great extent as possible in one or more places. By such an arrangement even small places will appear of much larger extent than if only short vistas within the grounds are provided, and more pleasing to the eye from the fact that a greater variety of objects may be seen at once.

16. Ornamental grounds will be pleasing in proportion to the number of beautiful pictures presented. If all parts are seen at one time, interest is soon satisfied. It is possible, however, to provide very many pleasing features on places even of small extent if the foregoing rules are carefully studied.

CHAPTER V.

SHRUBS, HEDGES, AND HARDY CLIMBERS.

SHRUBS may serve under some conditions, e.g., on small places, the purpose of screens when planted near the buildings, or near the street when the land slopes upward toward the house, but in very few places can they be used for shelter. They are especially adapted to add finishing touches and cause a blending between the trees and lawn or for massing in ornamental groups on small grounds.

They present a much greater variety in form, size, and color than the trees. Among them we have the most beautiful colors and variegations of foliage, the most beautiful grace of outline, and the greatest variety of forms and colors of blossoms, coming on more or less from the earliest spring to late summer or early autumn, which afford material for the most beautiful effects. Being small they will give a much greater number of forms and colors on places of limited size than can be obtained from the use of trees. For description of shrubs see Chapter XII.

Preparation of Land, Planting, Grouping, etc.

The preparation of the land, the pruning preparatory for and the planting of shrubs, are so similar to those required for trees that directions need not be repeated here. The same rules also as for trees should be followed in regard

to individuals or groups as to distance, blending of colors and forms, etc.

TWO METHODS OF GROUPING.

Two methods of grouping are commonly practised, i.e., 1st, the grouping of many flowering varieties in one mass whereby some kinds may be in bloom at all times from April to November, and 2d, the arrangement of large masses of one species or variety together so as to produce very marked effect. The former will generally give the most satisfaction on small grounds, but on places of considerable extent the most pleasing results will be obtained by planting many specimens of one kind in a group. For example, large groups of Forsythias, Spiraea Van Houttii, Hydrangia paniculata, Japanese snowball, etc., arranged in large masses, present beautiful views and strong contrasts that cannot be obtained in any other way.

At the entrance of the grounds, as in Fig. 36, beside the walk or drive, or at their forkings, as in Fig. 39, groups of shrubs fix the attention on the change of direction, and we pass on or change from one walk to another less conscious of the change of direction than if only the plain walk was before us.

Another use of shrubs may be found in their serving to give a reason for abrupt changes of direction or the termination of a walk, as shown in Figs. 40 and 41, and also to make a curved walk on small grounds appear the most natural and the shortest distance between two points, as in Fig. 31.

Change of curves in walks are made to appear more natural if the borders are more or less decorated with shrubs

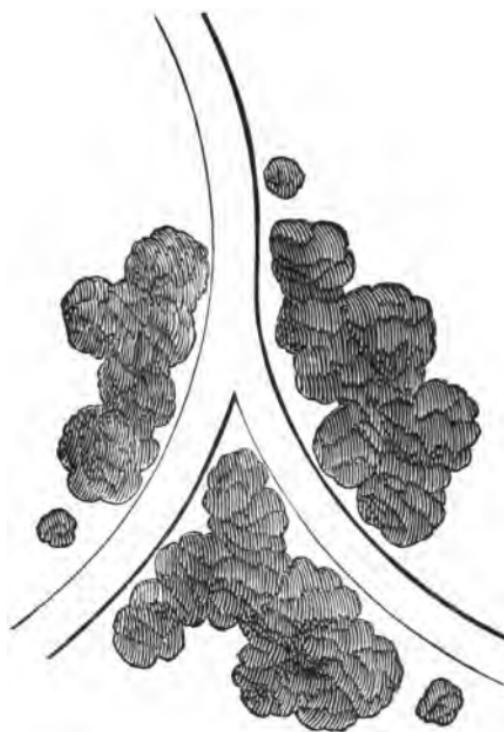


FIG. 39.—TREES AND SHRUBS GROUPED AT BRANCHING OF WALK OR DRIVE.

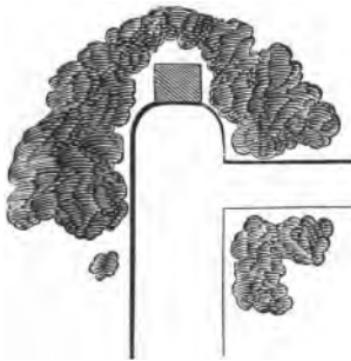


FIG. 40.

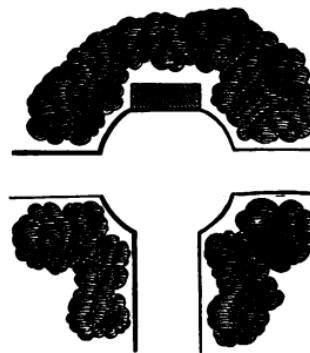


FIG. 41.

FIGS. 40, 41.—TREES AND SHRUBS GROUPED AT END OR TURN OF WALK.

at points where there would be a temptation to cut across to shorten the distance, as in Fig. 31. They also serve to cover up and break the monotony of the walk by obscuring changes until it becomes necessary for one to make the turn to reach one point or another. A combined group of trees and shrubs illustrating the shrubs planted a little way from the trees is shown in Fig. 34.

PRUNING OF SHRUBS.

In pruning shrubs they should be allowed to take their most natural and perfect form; and, when branches become old and weak, they should be cut away *from the inside*, thus thinning out and allowing new shoots to grow to take their place, as at *a*, Fig. 47.

The practice of shearing shrubs on the outside only, without thinning out any of the inside branches, cannot be too severely condemned, for it not only gives them an unnatural form in which there is little or no beauty, but it causes an increase in the number of small and imperfect shoots at the ends of the branches, thus shutting out the sunlight and resulting in a very imperfect growth, that produce very few, if any, flowers.

The best blooms of some kinds of shrubs are borne on wood of two or more years' growth, and the *annual pruning* often destroys much of this growth and forces the shrub to make wood at the expense of blossoms. In the case of the Hydrangia and Hibiscus, however, which bloom late in the season and from the new shoots, annual pruning of the old wood will result in larger and better flowers. Early-blooming shrubs, like the Spiræa, Weigelas, Forsythias, lilacs, Exochordia, etc., may be trimmed in

early summer just after blooming with the best results; while the Hydrangia, althea, and clethra, etc., should be pruned in fall, winter, or early spring. If left a long time unpruned, whether in groups or planted singly, most shrubs become irregular in form and lose their beauty.

By careful pruning and proper arrangement beds or groups of shrubs may be made to keep as good form and appearance for many years as if newly planted. The larger-growing shrubs should be planted in the centre and the smaller ones on the border of the groups, each kind thus showing its natural size and beauty if given space for full development.

Hedges.*

The arrangement of trees or shrubs in the close form of the hedge is under some conditions desirable and can often be done with pleasing effect, though generally only the very low hedge—one to three feet high—can be considered decidedly ornamental.

For the complete seclusion of the nursery and playground, the clothes-drying yard, etc., or where the space is very limited, the large hedge is sometimes allowable.

PREPARATION OF LAND.

To make a satisfactory hedge, the ground is to be as well prepared as for the growth of trees or shrubs under any other conditions, and as the plants are set out more thickly than where grouped for ornamentation, it should be made richer by an additional supply of suitable plant-food.

* See description of hedge-plants, page 219.

AVOID CLOSE PLANTING.

One of the greatest mistakes made in planting hedges is in the distance at which the trees or shrubs are planted. When set one foot apart or less, as is sometimes practised, if the kinds of plants used naturally grow to large trees, as with the hemlock, spruce, arbor-vitæ, honey-locust, etc., some of the plants will grow more rapidly than the others, some will die out, and all will be seriously injured by the attempt to grow them in so contracted a space. The distance best for planting must vary with the variety, but they should have room enough to enable them to make a sufficient growth to keep them in a healthy condition. Norway spruces, hemlocks, large forms of the arbor-vitæs, honey-locusts, etc., should be planted five feet apart at least, and be forced to spread out and grow laterally by cutting in at the top until strong main branches are formed near the ground. If immediate effect is desired, small plants may be set closely, and when they touch be transplanted again with a little greater distance between them or every other one be taken out. In this way, if plants are set over only one half of the line desired at first, as they crowd the line can be extended at less expense and with better results than if the whole distance were planted at once with trees of larger size.

REQUIREMENTS OF A PERFECT HEDGE.

The first requirement of a perfect hedge either for beauty or for a perfect screen is *numerous main branches close to the ground*, and at transplanting, unless the plants have been specially prepared in the nursery, they should be cut

back severely to encourage this condition of growth. It is not often possible to obtain hemlocks and spruces in proper condition for a perfect hedge, they not having been cut down while small, and they cannot be so severely pruned as can the deciduous trees; but the honey-locust, Japanese quince, buckthorn, privet, etc., can and should be cut down to within six inches of the ground at planting, even if of large size, and be kept low until sufficient strong lateral branches are developed to insure a close and healthy growth near to the ground. This may seem like severe treatment, but, as all trees or shrubs when planted closely tend to grow only at the top, in no other way can a perfect hedge be made that will grow a long time without becoming broken and irregular from dying of the branches. After the necessary lateral growth has been obtained the top should be cut a little higher each year until the proper height has been reached. The point at which to cut and the results of this pruning is illustrated in Figs. 42 and 43, the dotted



FIG. 42.

FIG. 43.

FIG. 42.—ILLUSTRATES CUTTING BACK OF A HEDGE.

FIG. 43.—ILLUSTRATES RESULTS OF CUTTING A HEDGE.

line *a* showing the point of first pruning. The effect of this pruning is shown in the three trees at the right; the line *a'* showing the second pruning.

FORM OF HEDGES.

Of the many forms in which hedges are pruned, a satisfactory and permanent growth will only be obtained by the triangular or conical shape, Figs. 44 and 45. When the



FIG. 44.



FIG. 45.



FIG. 46.

Figs. 44, 45.—CORRECT FORM OF HEDGES.

FIG. 46.—INCORRECT FORM OF HEDGES.

sides are pruned perpendicularly, as in Fig. 46, there can be but little growth except at the top, as at *a*; while in the conical or triangular form the tendency will be to grow upward from all points along the sides, as in the above figures, the sides being thus kept well covered with foliage and new growth.

PRUNING HEDGES.

As in pruning specimen shrubs, continual shearing at the ends will cause a more or less close, defective, and unhealthy growth, and here and there over the hedge weak



FIG. 47.—WHERE CUT SHOULD BE MADE IN PRUNING.

branches should be removed at considerable distance toward the inside, which, as shown in Fig. 47, *a*, will result in new

shoots from near the centre of growth and thus the vigor of the plant will be renewed. A hedge pruned in this way may not present quite so solid an outline, but it has a more graceful appearance, and will keep in a healthy condition much longer than when pruned only at the ends of the branches.

TIME FOR PRUNING HEDGES.

If it is desired to check the growth, as when the hedge has reached the desired height, the pruning should be done in June or July; but if more growth is desired, i.e., while the hedge is in the formative stage and to produce a lateral growth, the spring, just before growth begins, is the best time for pruning.

IMPLEMENTS FOR PRUNING.

For the preliminary pruning of cutting out branches from the inside the common hand pruning-shears and a large pruning-knife are all that is needed, but for giving permanent finished outline the long hedge-shears are indispensable. To obtain a true outline, strong twine stretched very taut and held in place by stakes is the simplest and most satisfactory method. If the surface of the ground on which the hedge is grown is curved, the top line of the hedge should take the same curve, thus making it the same height throughout its length.

A MIXED HEDGE.

Hedges of flowering shrubs, where the flowers are the most desirable feature, should be pruned as directed for other flowering shrubs, but the close solid hedge cannot be obtained by this method of pruning.

ADAPTABILITY OF SOIL AND LOCALITY.

As with trees and shrubs under all other conditions, the different varieties used for hedges will only succeed under proper conditions of soil and exposure. Thus the hemlock will only succeed when planted in a moist cool soil, in a cool yet somewhat sheltered location. The arbor-vitæs and all other evergreens are also often seriously injured if planted where exposed to extremely hot sun, heavy winds, or where passers-by will come in contact with them when frozen. The pines and spruces will grow well in light land.

Most of the deciduous trees and shrubs used for hedges succeed better in exposed places than the evergreens and under more varied conditions, but each must have a suitable soil to grow to the greatest perfection. Almost any soil may be so changed at little expense as to be adapted to the needs of most kinds of hedge-plants. If the soil is too light, liberal dressings of stable manure or other organic matter will enable it to retain moisture sufficient for a good growth. If very heavy, sand or gravel worked into the soil will make it more light and porous. If very wet, thorough drainage will remedy this defect.

The annual dressing of manure or fertilizer recommended for trees and shrubs should be put about the trunk of each plant before the ground freezes, and all leaves and rubbish that will attract mice or other vermin be removed before the ground is covered with snow. No weeds or seedling trees or shrubs should be allowed to get a foothold about the hedge, and in very much exposed places a protection of pine boughs during the winter will be found very beneficial until the plants have become fully established.

Hardy Climbing Shrubs.*

The part that hardy climbers play in the landscape or ornamental art is often very important. As a summer covering for verandas and arbors nothing possesses so much natural beauty. They supply the beautiful green so pleasant to the eye, and by constant evaporation of moisture from their leaves produce a cool shade that no artificial material can supply. Some of them possess most beautifully cut or shaded foliage, while others produce most beautiful flowers, and when once planted they grow on for many years with but little care. Some of them, like the wistaria, Aristolochia, Actinidia, bittersweet, etc., will twine about large pillars or other supports, some will support themselves to brick or stone walls by their suckers, while many, like the clematis, etc., require the support of the trellis, the single wire, or the wire netting.

If grown too abundantly or trained too closely to the building, vines often render the dwelling damp and unhealthy and cause rapid decay of the woodwork.

As to cultivation, they require the same care and fertility of soil as recommended for upright shrubs. Fig. 48 shows a vine-covered cottage in June, Fig. 49 the same in April.

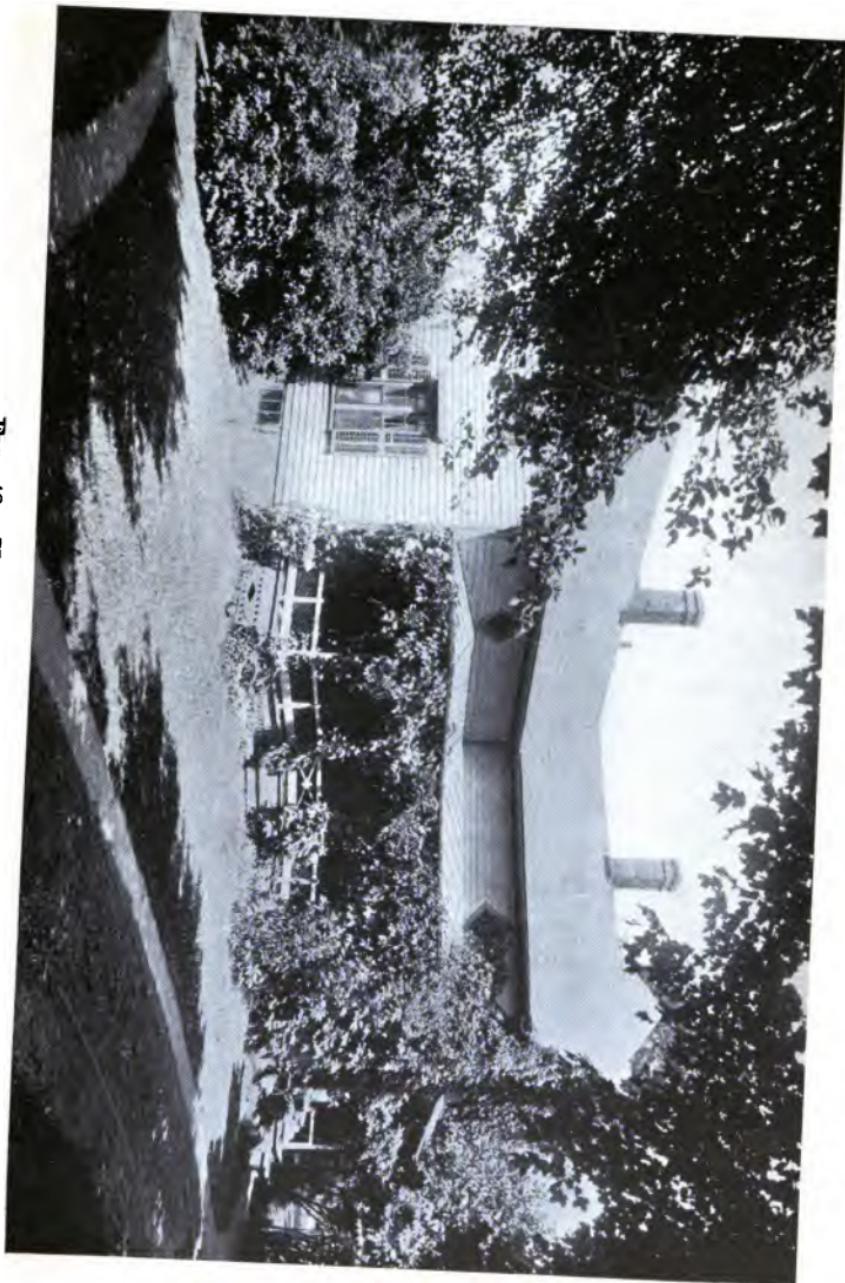
PRUNING OF CLIMBERS.

In addition to the pruning required to keep climbing vines within proper limits, which can be largely done by pinching and light clipping during the summer, they require in some cases the cutting back of the old wood of the laterals in order to produce fresh clean shoots and

* See description of hardy climbing shrubs on page 213.

FIG. 48.—VINE-COVERED COTTAGE.

(To face page 86.)



THE NEW YORK
PUBLIC LIBRARY

ASTOR, LENOX AND
TILDEN FOUNDATIONS

foliage, and in other cases the heading in of the young wood to encourage development of the blossom-buds. In a few cases winter protection should be provided by tying straw around them or covering them with matting. Any covering of this kind, however, unless very neatly done detracts from the appearance of a veranda or arbor and should be avoided if possible.

Hardy Herbaceous Plants.*

No class of plants affords more beauty and pleasure for so little expenditure of labor and money as the hardy herbaceous plants. They are especially adapted to small places, and with a background of low trees or shrubs some very beautiful pictures can be formed. As with shrubs and trees, some kinds require special conditions of soil to be grown successfully, while others succeed on a great variety of soils. Most of them will grow a long time in one place without renewal of soil, but some of them need dividing and transplanting every three or four years to insure the most vigorous growth and the best flowers.

They may be arranged in groups of the same kind, or in mixed groups, as may be desired, with good effect; but on large places generous groups of one kind with striking characteristics will be the most satisfactory, while on small places the mixed arrangement may, perhaps, give the most pleasure.

Tender Foliage or Flowering Plants.†

For many years past it has been the fashion to grow, more or less largely, brilliantly colored foliage or flowering

* See list of hardy herbaceous plants on page 222.

† See list of bedding-plants on page 242.

plants in large masses; and while the pleasure obtained by the growth and study of these plants is often very great, the effect produced is sometimes not quite in keeping with the quiet beauty of the refined home. It often partakes more of the nature of "loud dress," much avoided by all people of good taste. Gaudy pattern-beds covering large areas standing out conspicuously on the lawn with nothing to cause a blending of color cannot be considered in good taste, but if placed so that more moderate colors grouped near may tone down their intensity they may not be objectionable.

Small groups of the more brilliantly colored foliage-plants or of those with beautiful flowers placed in retired nooks with a good background, along the borders of walks, or close up to the veranda with a good extent of lawn often add brightness to a scene that can be produced in no other way. These bedding-plants, well started under glass, produce effect during the entire season which cannot be obtained from perennial plants or shrubs. They often show color or begin to bloom soon after setting out and continue until cut off by frost.

They are comparatively inexpensive if purchased from the commercial grower, or many of them are easily and cheaply grown with only the facilities of a small hotbed or a few sunny windows.

Intricate figures and designs often seen in public grounds and large estates should not be attempted on small places, for, besides being unsuited to such limited areas, they will detract from other features whatever of beauty they may possess.



FIG. 49.—VINES ON COTTAGE PRUNED.

(*To face page 88.*)



CHAPTER VI.

WALKS AND DRIVES.

Good, dry, and smooth walks and drives are a necessity for comfortable getting about on either the home or public grounds, but they can in themselves add nothing to the naturalness or beauty of any place. One of the first points for consideration, after the house and outbuildings have been located and built, is how to get to and from them, or, in other words, where shall the necessary walks and drives be located.

If we could always walk or drive on the velvety grass of a good lawn without getting our feet wet or killing the grass, gravelled or concrete walks or drives would not be a necessity, we should save much expense, and the beauty of our grounds would be greatly increased; but we can do neither of these, and walks and drives are therefore, from this point of view, a necessity.

A properly located walk or drive, however, may be made an attractive feature, as it invites us by its smoothness and dryness to walk or drive over it to the house, or from the house to our daily toil or pleasure. It adds an air of comfort and hospitality to the home that without it would seem cold and inhospitable.

Walks and drives in themselves add no beauty to grounds devoted to the growth of choice trees, shrubs, and plants,

and, as they are unnatural features of the landscape art, only such should be made as are actually required by those who frequent the grounds. Besides, a good walk or drive is expensive to construct, and requires constant attention as to border and surface to keep in good condition.

Location of Walks and Drives.

The location of walks and drives should be where they will be most convenient, and as nearly as possible give the shortest distance between the points to be traversed, and yet, unless the distance is very short, the straight line should be avoided.

Graceful curves, taking one from place to place about one's grounds, give the idea of quiet and leisure that is conducive to the study of beautiful objects about us; and by a little variety of material and skill in the arrangement of it in ornamenting the borders of walks, thus obliging us to move out of the straight line to reach a certain point, we may not be conscious of the fact that the curved walk is any longer than a straight one would be, and much beauty is gained. This is illustrated in Fig. 32; were it not for the groups of shrubbery along the border there would be a feeling of restraint at going over so much distance to reach a point directly ahead, but we are attracted in part by their beauty to pass among them, and, being between us and the objective point, the feeling of restraint disappears.

There should always be a walk leading more or less directly to the main entrance of the house; and where a drive must also be provided to the front door and to reach the stable, if space is limited, the two may be combined

for more or less of the distance by making that part along the side of the drive intended for the footpath (see Fig. 50) with a little finer gravel or by paving or concreting it.



FIG. 50.

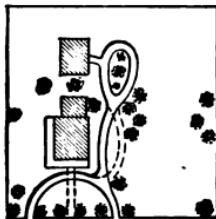


FIG. 51.

FIG. 50.—COMBINED WALK AND DRIVE.

FIG. 51.—SEMICIRCULAR WALK OR DRIVE.

Where the grounds are small and a "turn around" is needed, this plan is often followed, thus preserving more of the lawn for ornamentation and reducing the cost of construction and care.

Direction of Walks and Drives.

The direction of the walk leading from the house to the street should conform to the needs of the occupants. Thus, if the direction of travel is equally to the right and left from the street entrance, the walk should run nearly in a direct line from the main entrance of the house to the street, as in the dotted line Fig. 51, or in a semicircular direction, as in the same figure; but if the direction of travel is largely to the right or left, then the drive or walk can be directed to the right or left at the entrance, as desired.

Width of Walks and Drives.

The width of the walks and drives must vary with the amount of usage. If there is much passing to and from

the house, the walk may be made from 5 to 6 feet wide, so that two or three persons may walk abreast or pass each other readily; but if two persons would not be likely to meet frequently, a width of from 3 to 5 feet would be sufficient. For a drive where only one team would pass over the road at a time 8 to 10 feet is sufficient width; but if two teams must frequently pass over it at once, 15 to 18 feet will be none too great a width. The walks and drives, however, ought not to be wider than are absolutely needed, for the wider they are the more they detract from the ornamental features of the place and the greater will be the cost of construction and maintenance.

Obtaining the Curves.

Too much care cannot be exercised in laying out and forming the curves of walks and drives, for when completed with a proper foundation it is difficult to make a change of location or direction except at large expense.

Most inexperienced persons find some difficulty in obtaining graceful and proper curves, but to the professional landscape-gardner it is a simple matter.

The point of start and termination must be decided upon and also the prominent features that may be brought to view along its course. The walk should be made to pass if possible where pleasing features will be seen, and not where those of an unpleasant character will be brought to view.

Many means are employed to obtain the desired curve. If an engineer is employed, this is quickly and very accurately done with surveying-instruments; but for all ordinary work it can be done with sufficient accuracy by the eye, setting up small stakes at regular intervals, as in Fig. 52,

and sighting along until the line is covered (the more abrupt the curve the closer the stakes must be set), then viewing the stakes backward and forward once or twice, changing here and there until a satisfactory curve is obtained. The desired width at all points is then obtained by measuring the same distance from each of the stakes to the opposite side of the walk. On large grounds a carriage driven rapidly and skilfully over the surface will make very

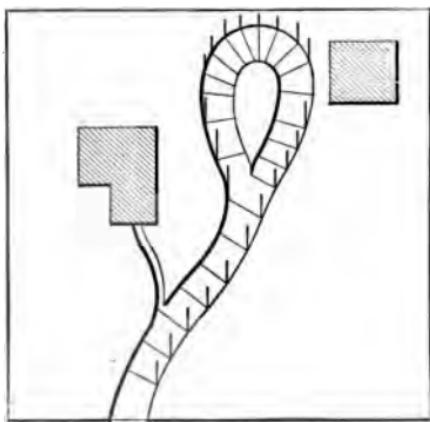


FIG. 52.—METHOD OF OBTAINING CURVE.

regular and graceful curves. The bicycle also may be brought into use for this work, or a stiff rope or rubber hose laid on the ground and moved until the desired curve is obtained, the mark to be made by pressing it into the soft soil with the feet, or if in grass the curve made in the above way may be located by setting up small stakes at frequent intervals along the line of rope or hose. After the curve is laid out permanent stakes should always be set firmly enough so that they may not be moved until the work of grading, filling, trimming, and smoothing off is completed.

Construction of Drives and Walks.

A good walk or drive cannot be made on a poor foundation, any more than a bridge or a house. A foundation must be provided that will not allow of settling unevenly by the action of frost. Standing water under the walk will also cause uneven settling, and one of the first steps to take in providing for the foundation is the removal of any surplus water. If not naturally underdrained, a tile or stone drain should be laid not less than $3\frac{1}{2}$ feet below the surface, and if the land is very wet and the walk wide a line of tile on each side, Fig. 53, may be necessary. On

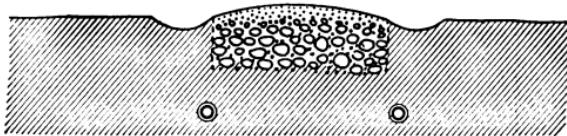


FIG. 53.—SECTION OF WALK OR DRIVE SHOWING LOCATION OF TILE.

a side hill a deep-laid drain on the upper side, Fig. 54, a little distance from the walk will often be more effective than if laid directly under it. If the whole lawn is well

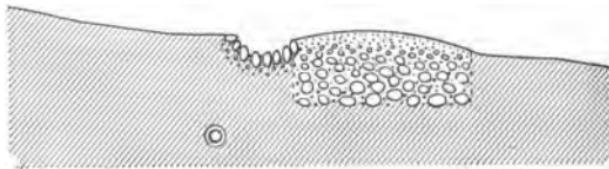


FIG. 54.—SECTION OF WALK OR DRIVE ON SIDE HILL.

underdrained, no other drainage need be provided except that obtained in construction.

To provide a walk that shall be dry at all times and especially after very heavy rains, the material of which it

is made should be of a very porous character. This condition is best obtained by excavating the whole space to be covered from one to two feet deep and filling in first with boulders and rocks, then with smaller stones and coarse gravel, and finally with gravel from which most of the sand or loam has been screened.

The rocks and boulders should be first packed as closely as possible, then the small stones filled in about them, and then the coarse gravel packed and tamped down thoroughly. If a heavy roller is obtainable and can be used at the different stages of construction, this will be the best means of compacting each layer, but if not, a heavy iron or wood tamper, used skilfully, will do good work.

A walk constructed as above described will remain firm and dry for a great many years, and will require little labor to keep it in a neat condition and free from weeds. The surface of such a walk may be made nearly flat, while if good material is not available and a good foundation is not provided it must be made crowning in the middle, and the poorer the material the more crowning it must be and then not be wholly satisfactory. The materials of which the walk is constructed should not be filled above the level of the lawn on a sloping surface unless found necessary, as the surface-water during heavy showers would accumulate, washing out the gravel. Should such a form be necessary, this danger should be provided against by making a gutter along the upper side of the walk, with catch-basins into drain tile or a tile culvert to carry the water under the walk. This gutter may be made as a part of the walk with paving-stones or asphalt, Fig. 54, or a very good one can often be made in the turf without disfiguring the lawn (see Fig. 53).

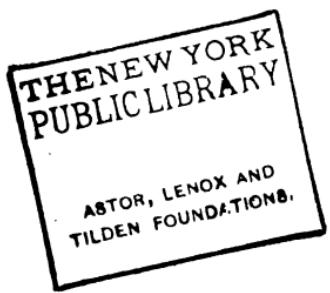
Care should be taken that no basins be formed by the walks or drives as they pass through the valleys or turn along the face of a slope, and if such become a necessity culverts of stone or tile should be put under them so that the water may pass to the other side before there is much accumulation.

The edges of the walks and drives will need more or less attention at all times to keep the grass from growing in and forming irregular borders, and trimming is best done with the "edging knife." The surface also will need an occasional raking or smoothing over, and once in two or three years a dressing of screened fine gravel or sand will greatly improve the surface and keep it filled up to the level of the lawn.

If the workmen employed cannot cut the edges to true curves by the eye, the garden-line should be stretched and stakes set at frequent intervals along the curve until a complete and perfect curve is outlined.

All weeds should be removed before they become so fully rooted as to require the hoe or hook to remove them.

On the drives all loose stones or those projecting above the surface should be removed at once, for, besides the discomfort they cause the traveller, they are seriously injurious to both the carriage and the road.



(To face page 97.)

FIG. 55.—RESULT of Too CLOSE PLANTING.



CHAPTER VII.

RENOVATING AND IMPROVING OLD HOMES.

THE established home is often far more difficult to treat than where the land is clear and new material only is to be used. It often is also the case that there are objectionable features that must be removed before anything like real beauty can be evolved; as, for example: 1st. Trees, shrubs, and vines may be so closely planted and so entangled that none of them can ever be made beautiful objects. This is shown to some extent in Fig. 55. 2d. There may be unnatural embankments, slopes, terraces, or basins. 3d. Bank walls, unsightly fences, and improperly located buildings. 4th. Unnaturally located and unnecessary walks and drives.

In other cases much valuable material may be found in a condition that, with a little proper care, may be easily improved so as to become objects of great beauty in a much shorter time than if new trees or shrubs were planted.

When a place is taken that has for a long time been under neglect or improper care, the walks overgrown and trees and shrubs more or less a tangled mass, there seems to be but one of two things to do, i.e., to either cut down everything on the place, clear up and grade the land, and begin as in a new place, or to thin out some of the least

desirable and trim up those of value and plant other desirable trees and shrubs in proper relation to each other among those standing (removing, of course, such as will absolutely prevent the growth of the new ones), give them careful fertilization, and then remove the old trees as soon as the new ones have made growth enough to serve the desired purpose of ornamentation.

Preserving and Improving Deciduous Trees.

In some cases deciduous trees may be found that by severely heading in, as in Fig. 17, at the dotted lines *a*, in a few years will become symmetrical and well-formed trees, as in Fig. 18. Such trees as the elm, oak, maple, and many others are very easily renewed in this way, but the evergreens when once they have lost their lower branches can never be renovated without great expense and loss of time.

Renewing Shrubs and Hedges.

Overgrown shrubs may be more easily renewed than large trees, as they will stand more severe pruning. If very much overgrown and in clumps, a part of the main clump



FIG. 56.



FIG. 57.



FIG. 58.

FIGS. 56, 57, 58.—A SHRUB DIVIDED AND PRUNED FOR TRANSPLANTING.

may be dug up and the remainder severely headed back, when a wholly new top will be formed. This is illustrated in Figs. 56 and 57. If the soil be then enriched and a

little pinching in of the strong-growing branches that tend to outgrow the others, bushes of large size may be made in a very short time to take perfect form, and often with far less labor and expense than if young shrubs were planted. After well establishing, the pruning given should be in the direction of the dotted line *a*, Fig. 58.

Hedges like the honey-locust, Osage orange, buckthorn, privet, and Japan quince, which have long been neglected, may often be renovated by a little heroic treatment. Fig. 58 is a sectional view illustrating the condition in which neglected hedges often are found. By cutting this hedge at the dotted line, and then as the young shoots grow unevenly pinching off the ends of the most vigorous, a uniform height and a low-branching condition may be soon attained, without which no hedge is either ornamental or useful.

A hedge is under some conditions an ornamental feature of a landscape view and often serves as a screen from some unsightly object; but generally there is little of the ornamental or useful about it. Where growing on old places in nine cases out of ten it will be found that more pleasing effects may be obtained by the removal of such a hedge and grass and a few naturally formed trees and shrubs planted about the place occupied by it than by trying to renew its growth. Evergreen hedges, when not too large, may be renewed by the heroic treatment, but it takes several years after heading in for them to become again covered with foliage so as to be ornamental.

For full description and care of hedges see Chapter V.

Hardy Herbaceous Plants.

On many an old place may be found more or less of those most interesting and desirable hardy herbaceous plants, like

peonies, phloxes, larkspur, iris, etc., that may be utilized in the decoration of a home. Generally they are root-bound among grass and shrubs, and can never be made of any value unless taken up and transplanted to good, clean, well-enriched soil. In doing this only the *strong young roots* should be used, and all grass and weeds should be carefully separated from them.

The fall is a good time for this transplanting, though it can be done successfully in the spring before much growth has taken place. If the land in which they are to be transplanted is not in a proper condition, the plants may be put in good garden-soil for a year or two, where they will be greatly improved and be ready for removal when a proper soil-bed is ready for them.

If the owner of a newly purchased old place is not familiar with the trees, shrubs, and plants on the grounds to be renovated, he should consult some one who can tell him of the value of each, that only those of value be saved.

Renovating the Lawn.

The lawn or the grass in and about the grounds of most old places has generally been so long neglected that weeds and wild grasses have taken possession and driven out the finer kinds that give the green velvety carpet, without which any place, no matter how lavishly planned or grandly built, looks unfinished. The first thing to do with the old lawn, if under such conditions that the land can be ploughed or otherwise worked deeply, is to turn the sod under, manure heavily, cultivate thoroughly for one or two years until the wild grasses and weeds are subdued, and then reseed in August or April with 1 to 2 bu. June-grass, 1 to

2 bu. red-top, and 8 lbs. of white clover per acre.* But it more often is the case that there are numerous trees and other objects on an old place that prevent this thorough treatment, and the cultivation of the land to the very door-steps, for even one or two years, is not a very pleasant thing to contemplate; therefore some other method of renovation must be resorted to. Under these conditions the surface must be graded by shaving off the projections as far as possible, raising up the turf and filling up under it where there are depressions, or grading over the uneven surface with good soil, so as to present an even and flowing outline. Then grass-seed of the same kind and at the same rate per acre as for the new lawn, i.e., 2 bu. red-top, 2 bu. June-grass, and 8 lbs. of white clover (the poorer the soil the more seed should be used), should be sown, raked in with a liberal dressing of fine manure, or fertilizer made as follows: 1500 lbs. of fine-ground bone, 300 lbs. of muriate of potash, and 200 lbs. of nitrate of soda or sulphate of ammonia, per acre. Treated in this way, if the grass is frequently cut during the summer, a good lawn may be obtained in two or three years.

For new seeding the potash and nitrate of soda should be thoroughly worked in with the soil some time before the seed is sown.

The specially prepared lawn-dressings are equally good in place of the above fertilizers, but more expensive.

Smoothing Abrupt Slopes and Embankments.

As far as possible all abrupt slopes and embankments should be graded down into well-rounded and graceful out-

* See Chapter III on Lawns.

lines. Such grades are much more beautiful than abrupt terraces or slopes, more easily cared for, and there is no danger from injury by the turf sliding down or being broken down by stepping upon it in the spring as the frost is working out of the ground.

It is often possible to remove unsightly bank walls and grade over the place with graceful rounded outlines that are more natural and beautiful, and wherever possible this should be done. By excavating in front of the bank wall, as in Fig. 59, a space may be obtained

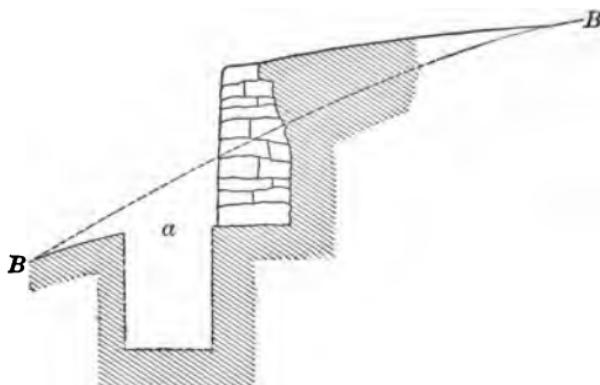


FIG. 59.—COVERING UP BANK WALL.

in which to cover up the stones if they are needed for no other purpose, when the surface may be sloped off at line *BB*.

In some cases, however, where the house is located on a very steep slope and very near the street, a retaining-wall becomes a necessity, under which condition the only way that the unnaturalness of the surface can be hidden is by covering the wall with climbing vines like the Japanese woodbine (*Ampelopsis Vietchii*), Fig. 118, page 214, or by

planting a row or border of shrubs or small evergreen trees in front of the wall.

Deep ditches and basins that cannot be easily graded over with material at hand often serve as a place for dumping rocks and other materials that may be gathered about the place or along the roadside, thus working great improvement in two directions. The small stones also will serve as the best kind of foundation for the walks and drives, while the good soil removed from the walk or road-bed will serve for grading or dressing over the uneven surfaces in other parts of the grounds or by the roadside.

Removal of Fences.

All fences are objectionable in view of their unnaturalness, lack of beauty, the expense of building and keeping in repair, and wherever they can be dispensed with it is economy to remove them.

Except in the village lot, where footpaths are likely to be formed by constant crossing, there is no good reason why

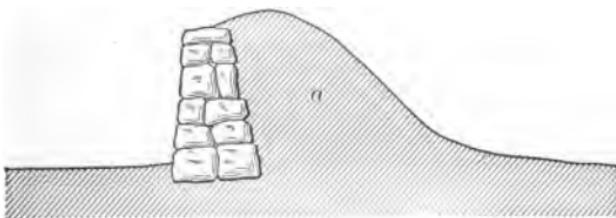


FIG. 60.—TURFING AGAINST BANK WALL.

fences may not be wholly dispensed with. It is sometimes the case in the country that cattle must be driven along the roadway every day to and from pasture, when a fence may be needed, but where there is only small chance of injury it is better to suffer the lesser of two evils. A stone

wall may often be covered from view by a bank of soil against it, as in Fig. 60.

Whatever fence is maintained should be as simple and inconspicuous as possible.

Improperly Located Buildings.

The greatest source of difficulty in improving established grounds is often found in improperly located buildings. We can easily dig up here and there a tree or prune them to good form and transplant shrubs and herbaceous plants with little cost, but to relocate buildings often entails great expense. One of the greatest mistakes made in locating buildings is in placing them too near the street and too closely together.

The main buildings can seldom be moved or changed without considerable cost, but the relocation of small buildings can often be easily made.

If possible, all the buildings should be located some distance from the street and far enough from the boundary-line to allow of some decorative trees and shrubs on every side of them, to serve as a setting for the central part of the home-picture, the house.

In case the buildings are nearly or quite on the line all the view to be obtained must be dependent upon that provided or allowed by neighbors, and the only thing that can be done to improve the beauty of the buildings is to plant vines to grow upon the wall or upon a trellis very close up to it.

If possible, the outbuildings should be located in the rear of the dwelling, at some distance from it, and more or less screened from the latter and from outside view, unless they

are more or less ornamental in character. The exposed view of a neat, comfortable stable is not objectionable, as it may be so arranged as to give the air of substantial comfort and extent to the grounds not to be found where only the house is in view.

Improperly Located Walks and Drives.

One of the most frequent faults to be found on an old place is improperly located walks and drives.

The proper location of these necessities of comfort is of the greatest importance, and the reader is referred to Chapter VI, where the matter is more fully discussed.

It must be borne in mind in the construction of roads and walks under all circumstances that a good road cannot be made no matter what the material used *unless the road-bed is thoroughly underdrained*, and the surface of the road or walk must have more or less curve or slope toward the sides to carry off the surface-water. The finer and poorer the material used, the greater this curve must be.

Wherever it is possible one or more lines of tile should be placed under the road-bed, at least three feet deep, with a good fall and free outlet for drainage.

The extent of the walks and drives should be limited to the *actual* needs of the place. The fewer the gravelled walks or roads the better; yet a place without at least a walk up to the front door, or a smooth drive to the stable, would look inhospitable or almost uninhabited.

While there is no beauty in walks and drives in themselves, yet if well laid out in graceful curves just where they are needed, and are well cared for, the variety they afford and the air of comfort and the inviting hospitality they give

to a place make them very important factors in all home landscape work.

In many cases the relocation of walks and drives is simply a matter of ploughing up the old one, grading a little and relocating, as a majority of these walks are made on the surface of the ground without previous subsoil preparation. If, however, a road-bed has been formed by excavation and filling in with stones, the work will be more expensive.

In relocating, the rules given in Chapter VI for the establishment of new roads and walks will be equally applicable.

An already-established place that needs improving may be likened to an unfinished picture the details of which must be filled out and retouched and any defects covered up, while in the new place we have but the canvas—the colors and other material are all new and fresh, i.e., the land, the rocks, water, buildings, grass, trees, shrubs, etc. The result in the first case depends largely upon how much and how good is the work that has been done, and how skilful the artist in adapting himself to the ideas already started, and in remedying defects. In the second case the results largely depend on the artist alone.

Farm-home Decoration.

The decoration of farm homes is a subject not often discussed in works on landscape gardening, but there is no place so susceptible of ornamentation as the average farm, and possibly no place where so little is done to improve the beauty of the home surroundings. Generally there is an abundance and a great variety of land, also a wealth of materials in the way of trees, shrubs, and plants that may

be used, and the tools, teams, and labor with which to bring about the ornamental results.

Our Farmers Cultivate Too Much Land.

Most of our farmers cultivate too much land, and they would in many cases grow rich faster if they cultivated less land and planted the less productive places, the odd bits, the rough stony fields and abrupt slopes, the small irregular lots in the angles formed by roads or fence lines, with trees that would be a source of beauty and in time add value to the property. Such decoration would be a source of pleasure to those doing the work and to all of the occupants of the home, and the pleasant associations and memories of the farm home, where beauty and utility are thus combined, will do much to make home the dearest of all places, and especially prevent the young men from leaving the farm for city life.

The rules for planting, arrangement, and care of trees and shrubs to be followed in this work are given in previous chapters. Many unsightly objects can be easily hidden from view, and the more beautiful features in the picture from the dwelling be brought out more prominently and improved.

Windbreaks for the house and other buildings may be easily provided, as well as shelter for the stock in the pasture against the fierce storms of spring and autumn and the burning sun of the summer.

A few majestic oaks, chestnuts, or other spreading trees in the pasture, or here and there dotted about the farm or near the buildings, add much to the beauty and character of the farm landscape, and every effort possible should be

made to encourage the growth of such and preserve any that may be already established.

Fruit-trees as Ornaments.

Fruit-trees on suitable land in many cases may be used in work of decoration on the farm, thus serving a double purpose. The apple, pear, and plum require a strong well-enriched soil and an avenue just inside the road boundary, bordering large mowing lot or farm roadways, if properly cared for so as to make well-formed heads, would be sources of great beauty when in blossom, and again when loaded with fruit in the autumn. The cherry and peach require a lighter soil with a full exposure of air, as on the brow of a hill or a western or northwestern exposure, and nothing is more beautiful than an avenue of pyramidal cherry-trees when in bloom early in the spring, while the beauty of the peach blossom and its ripening fruit have not been too highly praised in song and story.

The labor and expense required to produce the few touches of beauty on many of our farms to make them homes of comfort and beauty is very small, and the skill and taste acquired in this work will enable one to become more skilful in other directions, i.e., in growing and preparing many of the profitable crops for market.

It is generally conceded that the most successful and thrifty farmers are those who have a love for the beautiful, who keep their premises in a neat condition, and who have every tool kept in its proper place when not in use, and who never allow anything to be out of place longer than is necessary. No waste, no leaks are allowed, and if weeds or brush interfere with their growing crops, or with ornamental

or fruit trees, they are despatched. Love of order prevails everywhere, about the barn, by the roadside, as well as about the home-buildings, and beauty and thrift go hand in hand.

We are largely creatures of habits of thought or of labor, and anything done thoroughly, systematically, beautifully in one direction helps us more or less in all other lines of work.

Farm-roads.

Good farm-roads are a necessity for quick and easy transportation of the products of the farm. The principles of construction of such are the same as for other roads,* and where there is an abundance of stones they may be utilized for foundation and unsightly objects removed from the surface of the land or roadside.

Road-making is very expensive business, and few farmers find profit enough in their work to warrant the expense of long lines of roadway. Only such roads as are absolutely needed should be made, and the expense of construction will be felt less if only a short length is constructed at one time. Whenever stones are being picked up from the land, a convenient way of getting rid of them is to excavate a piece of roadway and cover them up with a dressing of gravel. This is far better than dumping them along the roadsides or in some other equally conspicuous place, where brush and weeds will grow up through and about them in such a manner that they cannot be eradicated except by finally removing the stones and tearing them out root and branch.

* See chapter on Roads and Roadside Improvement.

Removal of Stone Walls and Fences.

Except around permanent pastures and to protect fruit plantations from trespass, walls and fences are no longer a necessity. They are not ornamental no matter how nicely made, and are very costly to construct and keep in repair. They occupy a great amount of land, and the average stone or wood farm-fence gives harbor to mice, squirrels, and other vermin. It is also almost impossible to keep weeds and brush from getting such a foothold along their line as not to be easily dislodged, and ornamental trees and shrubs are much more subject to insect and fungous pests, making it very difficult to grow them successfully where such harbors for these pests exist. If one is located near a large and growing town or city, stone walls can be disposed of for building purposes, and the "stone crop" of many farms often becomes a large source of income.

Pond-holes and boggy meadows may be filled up with the accumulating small stones, covered over with soil, and thus land of some value be produced, while the stones are put where they will never cause further trouble.

CHAPTER VIII.

COUNTRY ROADS AND ROADSIDE IMPROVEMENTS.

IT is often said that the condition of the roads in any community is an "index of the intelligence of its people"; and while this may not be wholly true, the roads are an index of their thrift and prosperity, for without good roads frequent and easy communication cannot be had, farm crops and manufactured products cannot be taken to market at the same cost on poor as on good roads, because of increased time required for transportation, and the greater wear and tear of horses and carriages. Then there is little pleasure of comfort in riding over muddy, rough, and unkept roads.

In many sections the amount of money appropriated for the construction and repair of roads is sufficient to keep them in good condition, but this money is often expended with such poor judgment as to leave a large part of the roads practically uncared for. The work, too, is often let out to parties who know nothing of the principles of road-making, or whose greatest care is to make as much profit from the work as possible.

The Conditions Necessary for a Good Road.

To construct a good road three things are necessary, viz., (1) *well underdrained soil*, (2) *a good foundation*, and (3) *good road material* for the surface.

1. In ordinary road-making very little attention is given even to surface-draining, much less to underdraining, yet nothing would improve our roads at so small a cost as tile or stone drains under the road-bed: and no matter how good the surface material, a perfect road cannot be made without perfect drainage. If the land is very wet and full of springs, a line of tile on *both sides* of the road-bed, not less than $3\frac{1}{2}$ feet below the surface, may be needed. See Figs. 53 and 54. If the road is on a slope, the tile should be placed a little above the upper gutter to cut off all water that would flow to the surface.

2. A layer of stones from six inches to one foot in diameter, placed at a depth of two or three feet below the level of the road and well packed in at the bottom, provides good drainage for a time and makes a very solid foundation upon which to place smaller stones and a top layer of gravel six to eight inches deep. But for ordinary road-making this foundation will not be required if the surface-drainage and underdrainage are well attended to.

3. Good materials for road-making are often difficult to obtain without considerable expense, but with the good foundation resulting from thorough drainage fairly good roads are sometimes made with poor surface material.

Broken-stone Roads.

The best material for a permanent road is undoubtedly broken stone, and it will generally be found the cheapest in the end; and next to this is clean sharp gravel with more or less small stones intermixed. To make the broken-stone road requires the investment of considerable capital in stone-crushers and heavy steam-rollers, which is beyond the means of small towns.

The assistance now being offered by many States to suburban districts in the construction of State roads made on the most approved principles will lead to rapid progress in correct ideas of road-making; and the large number of bicycles now in use will furnish another incentive for further improvement.

In this volume no attempt will be made to give detailed instructions for the construction of broken-stone roads, but the discussion will be confined to the making and improving ordinary gravel roads.

Surface of the Road.

The most noticeable feature of the ordinary country road is its flatness and unevenness of surface and the little attention given to surface outline and underdrainage, both of



FIG. 61.—SECTION OF ORDINARY COUNTRY ROAD.

which defects can be easily remedied. A section of the ordinary road, as often seen, is shown in Fig. 61, where the shoulders are higher than the road-bed and with depressions or basins here and there, caused by settling from the weight of traffic or from the displacement by frost. Such a road will wear out rapidly where the water stands, will be un-

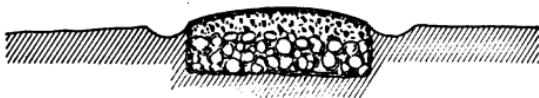


FIG. 62.—SECTION OF MACADAM ROAD.

pleasant to drive over on account of uneven surface and mud, and the worn particles of the road will not be washed

out to the side, but become fine dust during dry weather. Fig. 62 illustrates the modern macadam road with well-rounded surface and gutters; but whether the road be constructed of broken stone or not, the rounded surface and gutters are a necessity for a good road.

The surface of the road must be made more or less crowning, according to the material used. The poorer or more loamy the material the more must it be crowned or rounded. The shoulders made by the settling of the centre of the road, and by growth of grass and washing of the fine particles from the centre, should be removed *whenever they are so high as to interfere* with the quick passage of the surface-water to the side gutters. Gutters or ditches must be provided along the roadsides to prevent surface-water from washing up on the road surface and to catch and carry off quickly the wash from the road. These ditches must have frequent outlets and be without basins in which the water will stand.

On hillsides frequent bars must be made, and be kept in such condition at all times that no water will run over them into the middle of the road. They should start from the middle of the road and run diagonally to each side and not diagonally across the whole road. If made as in Fig. 63

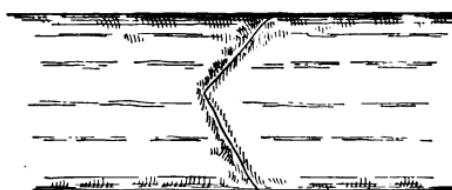


FIG. 63.—A PROPERLY CONSTRUCTED BAR.

both wheels will strike the bar at once and no side jolt will be felt, while if constructed as in Fig. 64 a very unpleasant

side jolt is produced and carriages are often seriously wrenched. On the upper side of a side-hill road good and frequently cleared gutters are needed to prevent washing, and also frequent culverts to carry the water across to the lower side; for if the water runs over the roadside and a

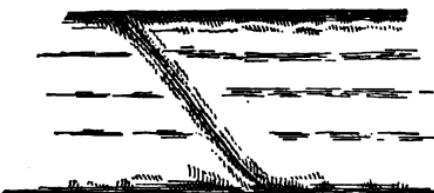


FIG. 64.—AN IMPROPERLY CONSTRUCTED BAR.

long distance in the middle of the road, it often gains such momentum as to do a great amount of damage during heavy rains.

Width of Road-bed.

The width of the road-bed as constructed by our road-makers is very variable, some making them from 15 to 20 feet, while others would make them only from 8 to 10 feet wide for the same amount of traffic. On most main roads between large towns and cities the width need not be over 18 feet wide, or only wide enough for two teams to pass readily, with rounded, sloping, well-turfed sides which will not be injured by an occasional turning out upon them, and crowning sufficiently to allow the surface-water to pass off quickly.

In less thickly settled districts a single width of road-bed, i.e., from 8 to 10 feet wide, will be as much as is needed, and will be much less expensive in construction and repairs than if made wider.

Repairing Roads.

One of the greatest mistakes made in repairing roads is in using poor material for dressing them over, when good material may be obtained at only a little additional cost.

The best gravel that is to be had within reasonable distance will generally be found the cheapest in the end.

A great mistake is often made also in spreading the repair material evenly over the whole road surface, as in Fig. 65, when one half of the material placed in the centre



FIG. 65.—AN IMPROPERLY GRAVELLED ROAD.

with the shoulders of the road removed, as in Fig. 66, would give far better results. If the material is put on



FIG. 66.—A PROPERLY GRAVELLED ROAD.

flat, the road-bed will remain flat, or grow more and more depressed in the middle, and none of the fine-worn material can pass off, but remains to make mud and dust; while if well rounded in the centre it will retain its form for some time, the fine-worn material or dust will be washed to the outside of the road, and less trouble will be experienced with mud and dust.

The gravel placed in the centre of the road will work to the outside as fast as it is needed to keep the form of the road-bed, and there is scarcely ever any good reason for

spreading it more than from 4 to 6 feet wide in a road-bed of a single width, or 8 to 12 feet in a double-track road.

As far as possible when dressing over a road the coarser material should be kept spread or raked forward as each succeeding load is added and well covered with the finer material.

Road-repairing should be done in the spring before the ground has become fully settled.

If the shoulders of the road are kept worked off by the road-scraper or plow, and a thin coating of gravel be put on in the centre each season, any ordinarily well underdrained road can be kept in good repair at a very small cost.

Road-scrapers when properly used are great labor-savers, and in sections where ordinary soil must be used—and there are many such—they save a great amount of labor and expense. Where the unworn material on the edges can be used to advantage, or for the purpose of breaking off the shoulders, the rounding of the surface of the road in the spring, the road-scraper will do the work quickly and thoroughly, but to use it during the summer for any other purpose than for scraping off the worn material will result in more harm than good.

The practice of turnpiking or scraping poor material, like turf and loam, into the middle of the road during the summer will largely account for the poor condition of many of our roads.

All turf turned up by the road-scraper or plow should be removed from the road-bed entirely and used for filling in over steep embankments, deep gutters, or in levelling up and otherwise improving the roadside.

Roadside Improvement.

In the rush and hurry to gain wealth or fame we Americans often forget everything but our immediate surroundings, and our roadsides, even in the vicinity of many well-kept residences, are in a state of utter neglect—not only this, but the roadsides are made a dumping-place for rubbish of all sorts.

It would require but little time or expense to put the roadsides in our towns and villages into a state of great beauty and neatness if all would work together in the right way. Perhaps the first and most important consideration in roadside improvement is that all shall refrain from dumping anything along the roadside, and the highway surveyor or road commissioner or agent should first set the example, and whenever trees are trimmed up or brush is cut along the roadside, or stones picked up or dug out of the road-bed, that all shall be *removed entirely from within the road boundaries*. All accumulations of stone or other rubbish should be removed, so that undesirable trees, shrubs, or weeds, can be easily eradicated.

The expense of this work need not be very great, for almost everywhere there may be found pond-holes, ditches, ravines, etc., where such materials may be dumped and covered up. The next important matter is the smoothing and evening up of the surface of the roadside. Here again those in charge of the repairs of the roads should take the initiative, and all turf and loamy soil not suitable to be put on the road-surface should be used for smoothing up and making gracefully curved or sloping roadsides.

Preserve Native Trees and Shrubs.

The native trees and shrubs should next have consideration. No country possesses so many beautiful woody plants as the United States; they are generally found growing where they thrive best, and any desirable kinds found growing by the roadside that can be made to produce a proper form of growth should be preserved and improved.

The laws passed by some of our States for the protection of shade-trees, whereby it is made the privilege (it should be the "duty") of the town or city authorities to mark such trees and shrubs as it is desirable to have preserved, and making it a criminal offence to destroy those thus marked, are steps in the right direction, and should be adopted in every State.

There is nothing which adds so much to the comfort of the travelling public as well-shaded streets, and a comparatively short time is required for our most rapid-growing trees to reach the size to afford considerable shade; but, whether we live to enjoy or see others enjoy their beauty and shade or not, we are certain that if properly planted in suitable soil more than one generation will be benefited by them. If every landowner would trim up and care for a few trees found growing by his roadside, or plant a few each year where none are now growing, it would be but a short time before our country would be noted for the beauty of its roadways, as well as for the general comfort and beauty of the homes of its common people.

Trees found growing by our roadsides will often be of many varieties and will seldom be in so exact lines as if set out, but often more real beauty will be the result of this variety and irregularity of line and spacing. In many cases very

beautiful results will be obtained by this irregular arrangement; at many points along a roadway interesting views of extended landscapes or glimpses of water are brought to view that would be hidden if the line of trees was unbroken. Fig. 60*a* shows a beautiful roadside picture.

Along almost every country road may be found young trees that have sprung up from seed planted by nature in the shelter of the stone wall or fence and hedge-rows. These trees are generally well rooted, and if allowed to grow and are given proper care as to pruning and protection while young they will make better formed, more hardy and long-lived trees than those grown in the nurseries. Should the trees have been injured by growing too closely, their form may be remedied as described in Chapter VII on "Renovating Old Places."

Fruit-trees along Roadways.

As a matter of economy fruit-trees along the roadsides are advisable, for they generally grow with great luxuriance with little care, produce large crops of fruit, and, in a measure, serve the purpose of ornamentation, but they do not give the desired shade, such as is produced by the elm, maple, oak, and other tall-growing ornamental trees, and which is one of the main objects of roadside tree-planting.

Planting Avenues.

In almost every section of our country we find beautiful avenues of shade-trees along the roadsides which have been planted by public-spirited citizens, and such avenues are grander monuments to their memory than stone or marble;



FIG. 60a.—A Roadside Picture.
(Copied from Bulletin No. 46, N. H. Agricultural College Experiment Station.)
(To face page 120.)

THE NEW YORK
PUBLIC LIBRARY

ASTOR, LENOX AND
TILDEN FOUNDATIONS.

but the amount of roadway thus decorated is very small as compared with that which is bare and possessed of little or no beauty. Village improvement societies, Arbor-day planting, planting-bees, etc., are doing much to encourage and increase the good work. The expense of the trees is very small, and it requires but an hour or two to obtain and plant a tree, and every landowner will find a few hours spent each year in thus adding to the beauty of his surroundings often the most profitable hours of his life, adding to the value of his property and building a monument that shall stand long after his face has been forgotten.

Ornamental Shrubs and Flowering Plants along the Roadsides.

The great variety of ornamental shrubs, vines, and plants that we find growing along our country roads, even when growing in neglect, are very beautiful features, and with a little care might be made to give as beautiful results as are often obtained on the lawn.

The planting of exotic or imported species under such conditions seems out of taste and cannot be recommended.

Grass alone under roadside trees and shrubs unless well trimmed is not a very ornamental feature, but is necessary to a perfect finish and setting of the trees and shrubs.

If the land is smooth and free from stones and can be plowed through to the roadway, the surface can be very easily graded up and finished around the ornamental planting, but generally the smoothing and levelling must be done by the slow process of digging off the projections and filling up the depressions.

The same smoothness that we find on the lawn is not to

be expected or desired, but there should always be a well-rounded gutter between the road-bed and the border.

As with trees, we find also a great many shrubs, ferns, and flowering plants already established along the roadsides, and but little care is needed to put them in condition of perfect growth. Shrubs can be more severely pruned and more quickly grown into perfect shape than trees.

This work, however, should not be left to the irresponsible road commissioner or agent, but should be in the hands of the village improvement society or some one who can be depended upon to trim out only the undesirable varieties and preserve such as are the most ornamental and of the best form.

Should the soil be very poor, a light dressing of compost or fertilizer should be used, but generally the road-wash can be so utilized as to make the best of top-dressing and produce the most perfect growth.

If we take the ornamental trees, shrubs, vines, etc., as we find them along our roadsides, we are pretty sure that the soil in which they are found is well suited to their growth, but if we transplant to fill up places not properly provided we must be sure to set out such as are suited to the soil and exposure of the place. Some species will only do well under conditions of a close tangled growth and such conditions must be provided for them, while those that only reach perfection in full exposure on all sides should be planted accordingly.

The custom in many sections of our country of regarding everything growing along the roadsides as common property will need some reform before roadside decoration can be carried out to its fullest extent, but the process of education is going on in our public parks and squares, in cemeteries

and school-yards, and there has been a great improvement in the respect that our people have for public decoration, they realizing more and more the great benefit such work is to the community.

Removal of Walls and Fences.

The removal of walls and fences wherever not needed to keep stock in the pastures will do more than anything else to help on the cause of roadside improvement. Stone walls and other fences are not needed except under the conditions mentioned on a previous page. They are a great source of expense to build and keep in repair, and in many sections of the country are being removed from the roadsides and along cultivated fields. Where the land is valuable, this is an important item, as considerable areas are made available for cultivation, besides greatly improving the roadsides and reducing the number of insects and vermin that neglected roadsides harbor. If a fence is decided to be necessary along the roadway or near dwellings it should be made as inconspicuous as possible. A woven-wire fence on gas-pipe or iron-rod posts all painted green will be the least conspicuous from all points of view and in the end not more expensive.

CHAPTER IX.

PARKS, PUBLIC SQUARES, SCHOOL-YARDS, ETC.

THE limits of this work will allow of very little discussion of the above lines of ornamental landscape-work, but it is a subject that is attracting so much attention and so much progress is being made in this kind of work that some of the principles involved will be briefly touched upon.

Nearly all of the parks connected with large towns and cities are under the direction and management of skilled engineers and landscape artists, and little that can be presented within the limits of this volume will be of value to them, but in many towns and cities we find so much imperfect work, and so much of a tendency to attempt more than the available funds will warrant or more than the managers can master, that we cannot but offer the suggestion that if less were attempted and the more natural features were developed and improved instead of trying to ape the larger parks which are far beyond them, there would be less of the shoddy work done and more that is really artistic and beautiful because of its naturalness.

The well-kept village green with a few large well-grown trees in perfect condition and with no fence around it is a thing of real beauty easily and cheaply cared for, far exceeding many squares or small parks fenced in with expensive iron or wooden fences, entirely unnecessary for any

purpose whatever, elaborate fountains, and attempts at statuary.

When the natural features of any park, square, common, or village green have been made as perfect as possible, and all made to blend and harmonize with the surroundings, then it is time enough to think of adding artificial objects. Let every tree, shrub, vine, or plant be made as perfect as possible. Let every rock or ledge too large to be easily removed be decorated with suitable natural growth of shrubs, vines, and plants. Let any body of water, stream or brooklet, be carefully and neatly decorated, and there is hardly a park, square, or green that will not be beautiful, that will not possess merit that will please any one with true artistic taste.

No work of decoration however small should be undertaken unless it can be done well, for half work is often worse than no work at all. No community need go to a great expense for plans or advice upon the subject of ornamenting public grounds, for there are many skilful men connected with the park systems of neighboring cities who will be glad to help on the cause of the ornamentation of public grounds. There are also men of skill and experience connected with the colleges and experiment stations of each State to whom they can go for advice, and our agricultural and horticultural press abounds in illustrations and suggestions for such work. What is most needed is some patriotic and energetic person or persons with a real love of nature and the beautiful who will take the lead and work unceasingly until success is attained. Such individuals are to be found in almost every community, and their efforts should be seconded and supported with substantial aid. The old-time "planting-bees" should be revived, or the

substitute for this, Arbor-day, when the planting of public grounds by the united effort of every one who can give a few hours to the good work, would soon result in beautifying all of our public squares, village commons, and roadways.

School-yard Decoration.

Much has been written in the past few years on the subject of the decoration of our public-school yards or play-grounds, and some progress has been made in teaching the average village schoolboy that there are some things about our school buildings and grounds that he ought to respect. Very little, however, can be done in this direction until the pupils come to see and understand the effect of beautiful surroundings and acquire something of a love for neatness and beauty, both inside of the school-house and on the play-grounds.

This may be accomplished in a measure if nature-studies are taught to our younger pupils in the public schools, or better still if at home they learn something of the beauty and wonders of the natural world about them, and of the necessity of some effort and restraint on their part in obtaining and preserving the things of comfort and beauty that they are permitted to use.

One of the first conditions or requirements of successful decoration of school-yards is an abundance of land. The quarter or half acre upon which school-buildings are usually located is by far too small to provide space for large numbers of children to play football, baseball, and other vigorous games and have any space for decoration, and it is useless to attempt anything more than the planting of a few large trees upon such grounds that will withstand the attack of

the crowd in their rush or run for the goal. On larger grounds where a liberal space can be assigned for the play-ground decoration of greater or less extent with smaller trees, shrubs, or plants may be attempted at points some distance from the play-ground and in the angles where there is no necessity or excuse for the pupils crossing the grounds.

It is always advisable to have the play-grounds and the sanitary accommodation of the boys and girls separated, especially in graded schools of the older pupils, which necessitates a larger area of land and more extensive decoration, and for a school of from 100 to 200 pupils not less than 1 to 2 acres will provide adequate space. This large extent of land is often difficult to obtain, but it will be found one of the best investments that can be made for our school-children, especially in thickly settled villages, and where the buildings are located near stores, railroad stations, etc. If the sanitaries are placed in the basement of the school-building, as they should be and are in many modern buildings, and the grounds are where they command full view from school doors or windows, the play-grounds need not be separated more than by an occasional group of small shrubs to distinctly mark the boundaries.

Reading-rooms, gymnasias, and other sources of entertainment and instruction provided for the pupils of our public schools will be found to aid greatly in the moral, physical, and intellectual training of our youth. Neatness and comfort should prevail everywhere, that each pupil may feel encouraged in very effort at self-control and good purposes. Figs. 67, 68, and 69 illustrate how school-yards of various forms may be divided into two separate yards and the arrangement of the trees and shrubbery. The arrange-

ment of shade-trees around the border is a desirable feature, whatever the size or form of the grounds, and if trees of

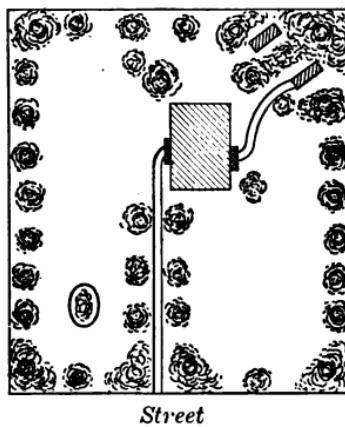


FIG. 67.—ARRANGEMENT OF SCHOOL-YARDS.

large size are properly planted they will not be often injured unless it is done wantonly, and with very little care are sure

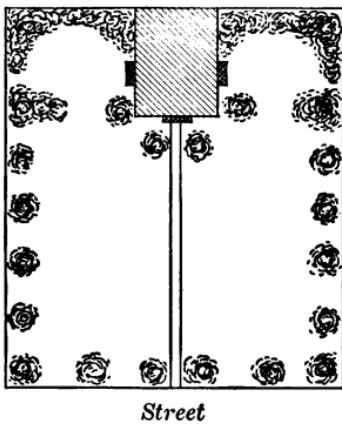


FIG. 68.—ARRANGEMENT OF SCHOOL-YARDS.

to give very satisfactory results. If the pupils can be interested in the work of decoration by the observance of

Arbor Day and field days, there will be little or no difficulty in keeping the sentiment of the school up where care will

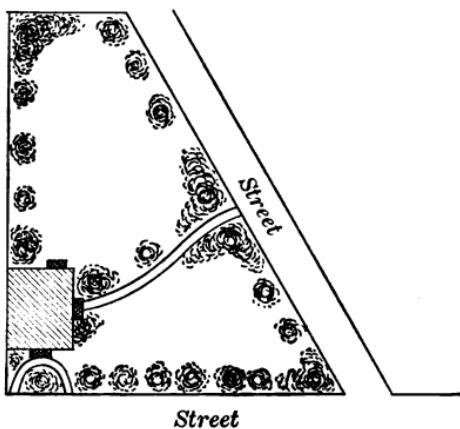


FIG. 69.—ARRANGEMENT OF SCHOOL-YARDS.

be taken that no injury is done to the ornamental material planted.

If all the pupils of a school can be encouraged to take up the study of the science of botany, and beds or plots of ground provided for the germination of seeds or growing of interesting plants, it will be a source of instruction and pleasure and lead often to more extended decoration; but where only one class takes up the work, the feeling of class jealousy is often such that work of this kind is not safe from molestation.

As in tree-planting by the roadside or on the lawn, the mistake is very often made of planting too closely for full and perfect growth.

No nuisance or objectionable views should be permitted near the school-house, and if distant views of beauty and interest can be preserved and unpleasant features shut out in the arrangement of the trees and shrubs, as they often

can be, it should be done. The more beautiful and attractive features that can be brought together about our school-houses and grounds the more easily will the pupils be governed, and the greater will be their progress in everything that makes for good citizenship and upright honorable lives.

Cemetery Decoration.

The decoration of the resting-places of those loved ones who have gone before has always received much attention, and special grounds in very village and hamlet have been set aside sacred to this purpose.

In the earlier days of our country the space devoted to this use was very limited and the geometrical style of ornamentation employed. The grounds, being enclosed by more or less pretentious fence and the trees and shrubs arranged in a stiff formal manner, often presented the most gloomy and uninviting features possible, instead of that quiet beauty and rest that we love to think of as the most appropriate resting-place for the bodies of our loved ones.

Within the past fifteen or twenty years, however, great progress has been made in beautifying these grounds, and to-day we have some of the most beautiful examples of natural landscape or ornamental gardening connected with our park cemeteries to be found anywhere in the world.

In the selection of the location for cemeteries naturally beautiful grounds, with more or less seclusion and quiet, away from the hurry and bustle of the village or city, and with a dry, rather light, porous soil, are most desirable.

The more natural features of beauty that can be found the more easily and cheaply beautiful and finished work can be done.

All such natural features should be preserved as far as possible, and no attempt be made to bring naturally rounded slope to the level. In case of very abrupt embankments some grading down must be done, but often by introducing large rocks and boulders into the face of the embankment the appearance of naturally projecting ledges or boulders may be produced, that will be far more beautiful than any rounded slope can possibly be made.

In most cemeteries the main source of income is from the sale of lots, and the great danger to be feared is that, in the desire to secure a large number of lots, the ornamental features will suffer, and too many lots with regular sides or too many geometrical walks will be produced.

Economy of space may perhaps be obtained by the arrangement of the ground into squares, but the lots with curved borders are susceptible of greater beauty in ornamentation. There is much greater ease and comfort in getting around by means of gracefully curved walks, and by the blending of all of the ornamentation into one system and under one management the whole may be made to reach much greater beauty than if each lot were ornamented separately. The care and ornamentation of cemeteries should be under one management, and with authority vested by the condition of the sale of the lots to compel each owner to keep his lot in a neat and orderly condition, or to have it done at his expense by the managers.

All the planting must be done within certain limits and rules be made and carried out that no one shall plant any tree, shrub, or vine that shall in any way mar the beauty of the whole.

Under the conditions of a great variety of soil and a large number of people of different ideas of the beauty

of the many kinds of trees and other plants that can be used with success in cemeteries, there is much danger of unsuitable trees being planted, and the superintendent must be a man of large experience as to what will give the best satisfaction under varying conditions and who has tact for dealing with the patrons of the grounds.

A boundary fence is often necessary, but not so often as is generally supposed, for almost everywhere, except in the extreme country districts, animals are obliged by law to be kept within proper enclosure, and when driven along the roadway to be kept as far as possible within the road limits, and the grounds can be made more beautiful if the fence is dispensed with altogether. If one must be put up let it be a simple gas-pipe or wire fence painted green. Near large cities, where more or less injury is done by irresponsible or vicious people, the fence becomes a necessary protection.

No fences, hedges around the lots, or other unnatural obstruction to the view of the whole grounds should be allowed, but in the arrangement of the general ornamental features secluded and quiet beauty should predominate.

The more distinctly graceful and ornamental trees and shrubs should be used in preference to the sturdy and grand trees, unless the extent of the grounds is very great, when the broad-spreading oak, chestnut, hemlock, and white pine may be used.

For directions for the care of the ornamental features of the cemetery, i.e., the lawn, walks, and drives, trees, shrubs, and plants, the reader is referred to the suggestions and rules laid down in Chapters III to VI.

An abundance of water is an absolute necessity for success in cemetery decoration, and service-pipes with faucets

at frequent intervals should be provided if a supply of running water can be obtained, for the best growth of lawn, shrubs, or plants cannot be obtained, especially in time of drouth, without its frequent use. If the supply of water is sufficient, sprinklers should be kept playing on some part of the lawns all the time during extreme dry weather. The quiet lakelet, the rippling brook, and the fountain are features that are especially appropriate for cemetery decoration.

Renovating Old Cemeteries.

Many of the old cemeteries of the country are of especial historic interest, as they often contain the only records to be found of much of our history, written on the tombstones found therein, and every effort should be made to save them from oblivion and make them pleasant features of our surroundings.

Not having been laid out in any formal style with walks, drives, etc., most of them present very favorable conditions for renovation to at least neatness and some show of quiet beauty. There are generally no boundary-stones to mark each lot, and the best and simplest way to produce beautiful results is to level down all mounds and projections with sharp spades, fill up all depressions with good soil, and make the surface a smooth and green lawn. After levelling and smoothing up the surface a dressing of fine rich compost or fertilizer should be given and an abundance of fine lawn grass-seed be sown and raked in. The headstones should then be placed in position, cleaning, repairing, and relettering such as are becoming obscure. The moss and lichens which indicate their age, however, should not be destroyed if it can be avoided. The trees, shrubs, and

plants found growing in such cemeteries are often in a sad state of neglect and need much care and attention. They should be treated in accordance with the methods described in Chapter VII on renovating old places, to which the reader is referred for suggestions. A few large spreading trees well cared for add much to the impressiveness of the scene, while large numbers of imperfectly grown specimens only invites neglect, and offers no attractions to those who wish to stroll about the resting-place of their ancestors or study the history of past generations.

Many of these old cemeteries are located in the very heart of thriving, hustling cities or villages, and while there are many sacred associations connected with the places, the noise and bustle of the town together with the inappropriateness of the location make it desirable and proper that they should be removed to other locations with more quiet and peaceful surroundings.

In this work every feature of the old grounds should be preserved as far as possible. The headstones should be set carefully in the same relative position in which they stood before being moved, and when so much is to be gained by removal no sensible person should object to what is a step in the direction of true honor and respect for our beloved dead.

Any place that is beautiful, quiet, and peaceful will have its influence on our hearts for good, and especially when in connection with so sacred a place, but the noisy street forbids any such influence, and the sooner these old cemeteries are moved to better surroundings and kept in proper condition the better, and the friends of the loved dead should rejoice that such conditions can be provided.



FIG. 70.—TYPICAL CITY STREET WITHOUT TREES.
(From the Tree-planting Association of New York City.)
(To face page 134.)

THE NEW YORK
PUBLIC LIBRARY

ASTOR, LENOX AND
TILDEN FOUNDATIONS

CHAPTER X.

DESCRIPTION OF TREES.

IN this chapter is given a brief description of the most valuable and beautiful trees, shrubs, and plants, and an effort will be made to point out in as few words as possible any peculiarities they possess or special treatment they may require for their most successful growth.

For convenience of reference they are arranged in the following groups:

1. Street- or avenue-trees.
2. Upright or round-headed lawn-trees.
3. Weeping trees.
4. Trees with fine or cut foliage.
5. Trees with colored foliage.
6. Evergreen trees.
7. Ornamental shrubs.
8. Climbing vines.
9. Hedge-plants.
10. Hardy herbaceous plants.
11. Ornamental grasses.
12. Bedding-plants.
13. Subtropical plants.
14. Aquatic plants.
15. Hardy ferns.

Street- or Avenue-trees.*

Nothing adds so much to the beauty and comfort of our streets and roadways, especially in the summer, as well-grown trees on both sides, and we find many towns and cities throughout our country noted for the large number and beauty of their street-trees.

The following list includes those best suited for this purpose:

Elm, American.	Ash, White.
" Slippery.	Oak, Red.
" European.	" Scarlet.
Maple, Sugar.	Chestnut, American.
" Silver.	Hickory, White.
Walnut, Black.	Tulip-tree.

AMERICAN OR WHITE ELM (*Ulmus Americana*), Fig. 72.—This is unquestionably the finest street or avenue shade-tree in the world. Its high arching branches spreading gracefully over the lawn, drive, walk, or roadway give an

* The appended list of trees is offered by the Tree-planting Association of New York City as being the most suitable to select from for growth in that city.

Norway Maple.	Tulip-tree or Tulip Poplar (<i>Liquidendron tulipifera</i>).
Sugar-maple.	Balsam-poplar.
Silver Maple.	Lombardy Poplar.
American White Elm.	Carolina Poplar or Cottonwood.
Scotch Elm.	American Linden (or Basswood).
Pin-oak.	Lime (or European Linden).
Red Oak.	Nettle-tree (Hackberry).
American White Ash.	Oriental Plane-tree.
American Sweet-chestnut.	Sweet-gum (or Liquidambar).
Common Horse-chestnut.	American Plane-tree (Buttonball or Sycamore).
Hardy Catalpa (<i>Catalpa speciosa</i>).	

If the Ailanthus is desired for planting, use only pistillate trees, as they give no unpleasant odor.



FIG. 71.—A WELL-DECORATED CITY STREET.
(From the Tree-planting Association of New York City.)
(To face page 136.)



abundant shade, and yet a chance for air to circulate freely under its branches. It varies greatly in form, from the broad round head to the very upright and strict vase form, all of them, however, assuming more or less the graceful arching growth.

It grows to the greatest perfection in a deep, moist, alluvial soil and is very easily transplanted. It is often taken from the swamp or pasture and transplanted to the open lawn or roadside with success, though nursery-grown trees if tall and clean with the branches 10 to 12 feet from the ground are more satisfactory.

In training a young tree a forked growth should be avoided, Fig. 24, and a single leading shoot encouraged with lateral branches established at intervals on opposite sides of the main trunk, as in Fig. 18. If allowed to make the forked growth, they are certain sooner or later to be split down by the weight of snow or force of storms. This should receive especial attention with trees taken from the woods or roadsides, and cut back to the "bean-pole" condition, as is often practised, and all of the lateral shoots be kept headed back until the leader has full control, as in Fig. 23.

SLIPPERY-ELM (*Ulmus fulver*).—This species is of a broader growth with larger leaves, but not quite the graceful form of the white elm, nor is it quite so large, but a valuable tree under some conditions.

EUROPEAN ELM (*Ulmus campestris*).—More upright and compact than the American species, and valuable where a less spreading tree is desired. All of the elms are subject to the attack of the elm-beetle, canker-worm, the elm-scale, and other insects, and need close attention to prevent their being seriously injured. See chapter on insects, page 261.

SUGAR-MAPLE (*Acer saccharinum*).—Perhaps no tree is so largely planted for streets and roadways as this, and it has many valuable qualities. It is clean, upright, easily transplanted, and grows rapidly, but is somewhat subject to disease and the attack of the maple-tree borer, maple-louse, and other insects and fungous pests which have often destroyed large trees and broken into many a fine avenue of stately growth.

SILVER MAPLE (*A. dasycarpum*), Fig. 73.—This rapid-



FIG. 73.—SILVER MAPLE (*Acer dasycarpum*).

growing tree is being largely planted in many places. It is a clean tree of great beauty, and thus far has shown no tendency to disease or the attack of insects. The tendency it has of forming several main forked branches must be



FIG. 72.—AMERICAN ELM (*U. Americana*).

(To face page 138.)



overcome by heading in all but the central leading branch, until it has become well established, as with the elms, shown in Fig. 23. This species thrives on all kinds of soil, but makes the best growth in a rather moist, deep soil.

WHITE ASH (*Fraxinus Americana*).—In growth this tree is very much like the sugar-maple with a little less of the conical form. The foliage is of a dark, rich color and free from insects and fungous pests. It is rather easily broken down by ice and wind-storms, and requires a heavy soil for its best development.

RED OAK (*Quercus rubra*).—Of the oaks this and the next species are the best for street decoration, but they can only be used along narrow roadways by training the

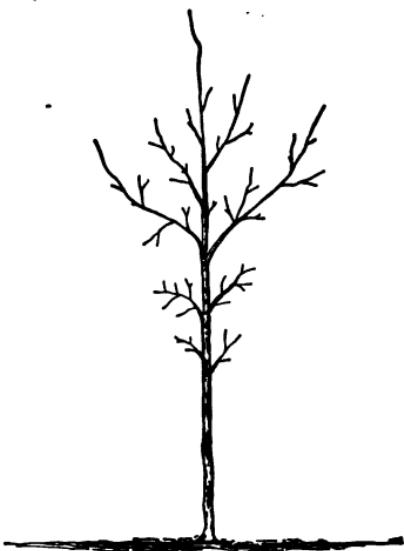


FIG. 74.—RED OAK PRUNED TO MAKE BRANCH HIGH.

branches high. This is best done by keeping the lower branches clipped in, as in Fig. 74, and when strong main branches have been formed high enough to be above all

danger of striking passing teams the lateral ones may be cut away entirely.

SCARLET OAK (*Quercus tinctoria, var. coccinia*).—Somewhat like the red oak in habit of growth, but with thinner and more deeply lobed leaves and producing more brilliant colors in autumn. The oaks are rather slow and heavy in growth, but when they become well established are especially desirable on account of their long life, sturdiness, and strength. They are difficult to transplant and can only be moved with certainty of success by frequent transplanting in the nursery. To prepare an oak standing in the field for successful transplanting, a trench 10 inches to 1 foot wide must be dug about the tree from 2 to 4 feet from the trunk, according to size, and at least 2 feet deep. This trench should be filled with good soil to encourage the development of fine fibrous roots. In two years' time, if the work has been well done, enough fibrous roots will be formed to render transplanting safe.

AMERICAN CHESTNUT (*Castanea vesca, var. Americana*).—This tree grows to the greatest perfection in many sections of the United States, and in soils where the elm, maple, ash, and oak do not thrive. It is free from disease and the attack of insects, rapid in growth, with a beautiful dark green foliage, and its abundant flowers in July make it an attractive feature of the landscape. Its fruit, too, is valuable and might be made a source of some profit if properly managed. Like the oak, it is difficult to transplant, and it has the same tendency to branch low when planted in full exposure, but these objections can be remedied in the same manner as with the oak, and its broad-spreading habit with proper treatment would make it a close rival of the American elm.

WHITE HICKORY OR SHAGBARK (*Carya alba*).—On very heavy soils this tree may become a very good street-tree, but on light land it would be of no value. Its habit of growth is tall and upright, with bright green foliage, and is generally free from insect or fungous attack. It is even more difficult to transplant than the oak or chestnut, but it may be started from seed where it is to grow or be prepared for transplanting in the nursery or fields, as is the oak or chestnut.

BLACK WALNUT (*Juglans nigra*).—No grander tree can be found among those native of the United States than the black walnut as occasionally seen in the Eastern States and very frequently in the West, but it is not often seen planted in avenues. It is difficult to transplant and requires a rather heavy soil for its best growth, but if properly treated, i.e., like the oak and chestnut, will make very beautiful street-trees. It is rather slow in growth, and requires a little care to prevent the formation of low-forked main branches.

TULIP-TREE (*Liriodendron tulipifera*).—This is one of our most beautiful trees, and if it could be more easily transplanted would be more largely used as a street- or avenue-tree than it now is. The fibrous roots of this tree are very succulent and easily injured by extreme pressure or by exposure to drying winds or sun, and the greatest care must be exercised in transplanting it. If transplanted frequently in the nursery, it may be safely moved until it reaches the growth of 3 or 4 inches in diameter; otherwise only young trees should be used, and more careful protection be given them against injury than would be required for larger trees of other species.

Many other species of trees might be used for street or

avenue decoration under some conditions, but the above list includes the best for general purposes. Scarcely one tenth of our roadways, and probably much less, are adorned with ornamental trees; even in many of the thriving towns and cities little attention is given to this matter, and the author would urge the use of more variety of species and less of the stereotyped kinds, like the elm and maple.

Upright or Round-headed Trees.

The following list, while not including all the trees desirable under varying conditions, yet contains the greater number of the most beautiful and especially those that will most certainly thrive under ordinary care. Many of the very new or rare varieties are not included for the reason that little is known of their real value, and it is almost the universal experience that a large percentage of the new introductions fail to realize the promise of their early growth soon developing some weakness, disease, or undesirable features, and their value cannot be determined until they have been tested for many years under various conditions of soil and exposure.

LIST OF UPRIGHT OR ROUND-HEADED TREES.

Maple, English.	Chestnut, Horse.
" Norway.	" " Red-flowered.
" Sycamore.	Shadbush.
" Schwerdler's.	Birch, European White.
" Reitenbach's.	" Sweet or Cherry.
" Red.	" American White or Gray.
" Tartarian.	Catalpa.
" Japanese.	Cherry, Flowering.

Redbud.	Box-elder.
White-fringe.	Cork-tree, Chinese.
Dogwood, Flowering.	Locust, Yellow.
Hawthorn, English.	Willow, White.
Golden-chain.	“ Golden.
Beech, American.	“ Red-twiggled.
“ European.	
Ash, European.	Basswood or Linden, American.
“ Aucuba-leaved.	“ “ “ European.
Locust, Honey.	“ “ “ White-leaved.
Coffee-tree, Kentucky.	Mountain Ash, American.
China-tree.	“ “ European.
Plane-tree.	“ “ Oak-leaved.
Poplar, or Abele Silver.	Hop-tree.
“ Bolley’s.	Oak, White.
“ Black or Italian.	“ Red.
Peach and Plum, Flowering.	“ Scarlet.
Apple, Flowering.	“ Swamp White.
“ Chinese.	“ Pin.
Sweet-gum.	“ English.
Magnolia, Umbrella.	“ Fern-leaved.
“ Cucumber.	“ Variegated.
“ Soulange’s.	“ Purple-leaved.
“ Swamp.	“ Pyramidal.
“ Showy.	“ Chestnut.
Mulberry.	Elm, Scotch.
	Larch, European.

ENGLISH MAPLE (*Acer campestris*).—A slow-growing maple forming a compact small tree, with corky ridges on the bark and handsome foliage.

NORWAY MAPLE (*A. platanoides*).—While young this tree resembles somewhat the sugar-maple, but as it grows older it takes on a more rounded, massive head. The leaves are broad and thin, palmately lobed, and change to a light golden color in the autumn. Its large flowers and broad-winged fruit are also ornamental. It is easily transplanted and thrives in ordinarily good soil.

SCHWERDLER'S MAPLE (*A. p., var. Schwerdlerii*).—During the spring and early summer the young leaves of this tree are beautifully colored with purplish crimson, but they soon change to a dark bronze green. It is one of the most beautiful and ornamental of the maples during this early growth.

REITENBACH'S MAPLE (*A. p., var. Reitenbachii*).—This is not quite so beautifully colored in the spring as the last, but retains its color later in the season. Also very valuable.

SYCAMORE MAPLE (*A. pseudo-platanus*).—A handsome broad-spreading tree, similar in form to the last, with large, thick, dark green leaves. It is rapid in growth and free from the attack of insects and fungous pests. It is rather heavy and coarse in growth and is not as beautiful as either the sugar or Norway maple.

RED OR SCARLET MAPLE (*A. rubrum*).—Our common swamp or red maple, found growing throughout our Eastern, middle, and Western States, where it gives the most brilliant coloring to the landscape by its bright red flowers and fruit in the spring and the variously colored leaves in the autumn. It grows best in rather moist locations, is easily transplanted, and free from disease.

SILVER MAPLE (*A. dasycarpum*).—See Avenue- or Street-trees.

TARTARIAN MAPLE (*A. Tartarica*).—A small tree with small cut and lobed leaves, somewhat like those of the gray birch, making an interesting and beautiful tree when in flower or in fruit and again by its brilliant coloring in the autumn.

JAPANESE MAPLES (*A. polymorphum and Japonicum*).—These are small-growing trees possessing a great variety

of forms and coloring of foliage. They are very difficult to propagate and therefore are expensive, but in deep warm soil a little sheltered from extreme drying winds they thrive well and make most beautiful ornaments. The first-named species has produced the most varying forms, some of which have finely cut fern-like leaves, and of varying



FIG. 75.—JAPANESE MAPLE (*A. polymorphum*).

colors from dark green through many stages of variegation to the darkest red or purple.

Among the best of these are:

Red-leaved Japanese maple (*A. p.*, *var. sanguineum*). Fig. 75.

Purple-leaved “ “ “ (*A. p.*, *var. atropurpurum*).

Purple cut-leaved weeping Japanese maple (*A. p.*, *var. dissectum atropurpurum*).

Green cut-leaved weeping Japanese maple (*A. p.*, var. *pinnatifidum*).

Rose-variegated cut-leaved weeping Japanese maple (*A. p.*, var. *dissectum roseo-pictis*).

Rose-margined Japanese maple (*A. p.*, var. *roseo-marginata*).

Plain-leaved Japanese maple (*A. p.*).

" " " " (" *A. p.*, var. *Jaconita*).

Golden- " " " (" *A. Japonica*, var. *aurea*).

Crisped- " " " (" *A. Japonica*, var. *crespa*).

HORSE-CHESTNUT (*Aesculus Hippocastanum*).—This tree possesses much beauty in its compact regular form and dark green foliage, but it is especially beautiful when in blossom with its large, compact panicles of white and rose-colored flowers. It is easily grown from seed, readily transplanted, hardy, and succeeds on a variety of soils.

RED-FLOWERED HORSE-CHESTNUT (*A. H.*, var. *rubicunda*).—Although not quite so conspicuous a tree as the last, it has more of the quiet beauty, with its dark green foliage and light red flowers.

SERVICE-BERRY OR SHADBUSH (*Amelanchia Canadensis*).—A native tree of small size that produces the most beautiful mass of pure white flowers very early in the spring before any but the fruit-trees are in bloom. It is perfectly hardy, but is liable to be attacked by the apple-borer and must have frequent attention to prevent injury by this insect. It succeeds best in rather sheltered locations, and "though a native" deserves much more frequent use.

CANOE-BIRCH (*Betula papyracea*).—There is scarcely a more beautiful or easily grown tree than the canoe-birch. It succeeds in nearly all kinds of soil and is transplanted

without much difficulty if trees of too large size are not attempted, those of 1 to 1½ inches in diameter being the best. It is especially beautiful when planted among evergreens or in contrast with trees and shrubs with bright yellow or red shoots for winter effect.

EUROPEAN WHITE BIRCH (*Betula alba*).—Somewhat similar to canoe-birch, with smaller foliage and perhaps a little more graceful outline. A desirable tree, though the cut-leaved weeping form is so much superior that it is not often planted.

SWEET OR CHERRY BIRCH (*B. lenta*).—Few of our native trees are more regular or graceful in outline than this species when grown in full exposure, but it being a common native tree and producing no conspicuous flowers it has not received the attention it deserves. Trees from the woods or roadside are difficult to transplant, but when grown in the nursery are easily transplanted. They succeed best in a rather moist soil.

AMERICAN WHITE OR GRAY BIRCH (*B. populifolia*).—A very pretty tree when grown with a single trunk or in the group or clumps it so naturally makes. It is easily transplanted while small and grows well in the poorest kinds of soil. In transplanting large trees, i.e., from 1 to 3 inches in diameter, the trunk should be cut down to the ground and one or more shoots be allowed to grow as desired. This treatment gives a vigorous straight growth that may be put into any shape desired and the growth is very rapid.

AMERICAN CHESTNUT (*Castanea Americana*).—If allowed to grow with full exposure, this will make a very broad round-headed tree, and is very beautiful upon large grounds. Description and treatment for transplanting were given under Avenue- or Street-trees. The fruit of the

Spanish and Japanese varieties is much larger but not of as good quality as that of the American, and the trees are less vigorous. Improved varieties of our native chestnut with fruit of large size are now offered and established trees are sometimes grafted with them with success. The smaller and more vigorous the stock the more certain the success in grafting.



FIG. 76.—CATALPA SPECIOSA.

CATALPA (*Catalpa speciosa*), Fig. 76.—A beautiful tree

of subtropical effect, producing very large heart-shaped leaves and large panicles of flowers after nearly all other trees have bloomed. It is not quite hardy at the North and the trees should not be transplanted to full exposure of the lawn until they reach 2 to 3 inches in diameter to be most successful.

FLOWERING CHERRIES (*Prunus, sp.*).—Several of the flowering cherries are offered by nurserymen. They are very beautiful for a few days when in bloom, but the flowers soon fall off and the trees are short-lived. If planted in a light soil and grown slowly, they will live in a fairly good condition much longer than in a heavy or very rich soil. As they grow rapidly, they may be used temporarily, until more permanent trees have reached a good growth, when they can be removed.

REDBUD OR JUDAS-TREE (*Cercis Canadensis*).—This is a very beautiful small tree, often taking the shrub form, producing an abundance of bright pink flowers before the leaves appear. The latter are of a very dark rich green color that is ornamental all summer. If grown too rapidly while young, it often winter-kills, like many of the trees coming from the middle and Southern States, and succeeds better in the lawn than if planted in a rich border; enough plant-food, however, must be used to produce a fairly vigorous growth.

WHITE-FRINGE (*Chionanthus Virginicus*), Fig. 77.—Although generally grown in the form of a large shrub, with a little care this may be made to produce a single trunk by pinching or cutting off all lateral buds and shoots on the main trunk. It is very beautiful, with lace-like fringe of flowers hanging from its small branches, and, like

the redbud, requires some care to prevent an excessive growth, which would make it liable to winter-killing.



FIG. 77.—WHITE-FRINGE (*Chionanthus Virginicus*).

FLOWERING DOGWOOD (*Cornus Florida*), Fig. 78.—This small tree requires some protection from the hot sun and drying winds of winter to reach its greatest perfection. In full exposure the large white bracts about the flowers, the ornamental part of the blossoms, are often injured, but under the shade of larger trees, on the north slope of a hill or in the shade of buildings and in rather moist soil, it becomes one of the most beautiful of our native small trees. The pink or red form of this species is also very beautiful and valuable.

ENGLISH HAWTHORN (*Crataegus oxyacantha*), Fig. 79.—The double-flowering hawthorns are among the most beautiful of the small trees. The flowers are very brilliant

and abundant and the foliage is of a beautiful dark green color, but, like all the rosaceous plants, the flowers are of



FIG. 78.—FLOWERING DOGWOOD (*Cornus Florida*).

short duration. The tree is subject to the attack of both the flat- and round-headed apple-borers and the leaves to several species of fungi, for treatment of which see chapter on Insects and Fungi. The varieties known as Paul's new double, white and red, are among the best.

GOLDEN-CHAIN OR LABURNUM (*Cytisus Laburnum*).—Where this half-hardy shrub or small tree succeeds, it is one of the most beautiful yellow-flowering trees in existence. It must be grown slowly in the lawn or where the roots of other trees keep the soil in a rather poor condition, although enough plant-food must be applied to produce a fair amount of wood.

AMERICAN BEECH (*Fagus ferruginea*).—This is one of

the finest American trees, but requires a cool moist soil and protection from the hot sun. It is so difficult to transplant that it is not often seen in cultivated grounds, and is rather

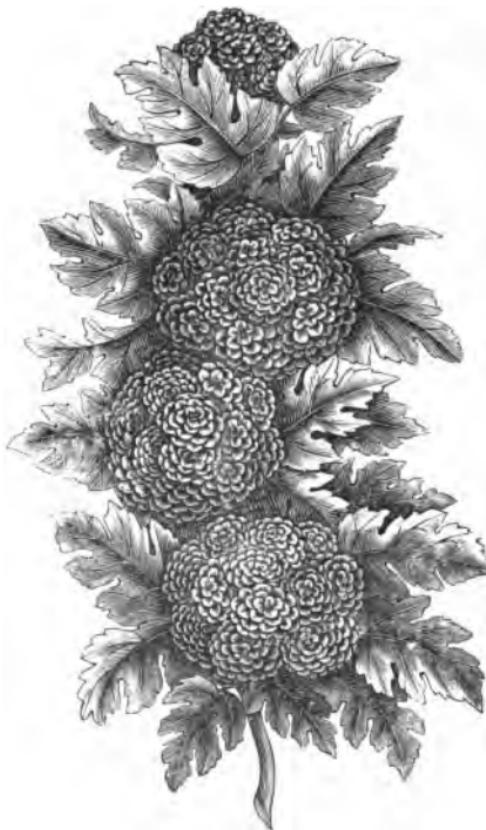


FIG. 79.—ENGLISH HAWTHORN (*Crataegus oxyacanthus*).

objectionable as a lawn-tree on account of the leaves, which adhere to the branches nearly all winter. Under some conditions on a large place and among groups of evergreens the very light brown or almost white winter foliage produces pleasing effects.

EUROPEAN BEECH (*F. sylvatica*).—Rather more graceful in growth than our native species and more easily trans-

planted, but the winter foliage is of a darker color and not quite so ornamental. This species has produced many interesting and beautiful forms, which will be described under their proper heading.

EUROPEAN ASH (*Fraxinus excelsa*).—This somewhat resembles our native ash in form of tree and color of its foliage; it is easily transplanted and many of its varieties possess considerable value.

AUCUBA-LEAVED ASH (*F. Americana, var. aucubæfolia*).—A beautiful tree with variegated foliage, but not so vigorous in growth as the common form. Valuable to plant in contrast with trees of purple or dark green foliage.

HONEY-LOCUST (*Gleditschia triacanthos*).—A large tree with beautiful foliage and large, often branched thorns, which cover more or less the main branches and sometimes the trunk. It varies much in shape, sometimes making very irregular growth, but it can be trained to a good form by a little judicious pruning. Compact, finely branched trees should be selected if planted on the lawn.

KENTUCKY COFFEE-TREE (*Gymnocladus Canadensis*).—A hardy native tree with feathery compound leaves, large stiff branches, and large panicles of flowers. Valuable for its subtropical effect.

CHINA-WOOD (*Kælreuteria paniculata*).—A hardy imported tree with good foliage and large panicles of yellowish white flowers in July. It is valuable on account of its large masses of flowers opening so late in the season.

PLANE-TREE OR BUTTONWOOD (*Platanus occidentalis*).—Were it not for the disease which attacks this tree it would be among the most desirable for ornamenting large places or roadsides. Its most conspicuous features are the white and olive patches of its very smooth trunk and branches

caused by the annual scaling off of the outer bark. A blight, however, attacks the leaves in the early summer, which causes many of them to wither and fall off, but are followed by perfect foliage again later in the season. As a result of this disease the branches become weakened and are easily broken off by wind and storm. It requires a moist rich soil and some very beautiful specimens are found growing in river-bottom lands in many sections of the country.

POPLARS.—Very few, if any, of the poplars are of any value for permanent growth. They are very rapid in growth, easily transplanted, possessing many varying forms and colors, and useful where immediate effect is desired.

SILVER POPLAR OR ABELE (*Populus alba*).—This very rapid growing tree is especially conspicuous when the silvery under-surface of the leaves are turned up by the wind. It has the fault, however, of throwing up suckers from the roots and is sometimes attacked by insects. To prevent the suckers from gaining strength and becoming troublesome, they should be pulled up, when the shoots separate from the root, and not be cut off at the surface. If cut off at the surface of the ground, the whole root system remains perfect and the buds are ready to start again with renewed vigor.

BOLLEY'S SILVER POPLAR (*P. alba, var. Bolleana*).—This tree is of a more close and spiry growth than the last, with leaves of a darker color above and equally silvery beneath, and though not fully tested under all conditions promises to be more valuable than the common Abele.

BLACK POPLAR (*P. nigra*).—A most rapid growing tree of a pyramidal growth and dark green leaves. Trees started from cuttings in 1874 are now more than $2\frac{1}{2}$ feet in diameter and 60 feet high. It has, however, developed a

very serious fault in that the lower leaves are attacked by a leaf-rust. As this disease is confined largely to the lower leaves, there is no difficulty in checking it, if not wholly preventing, by spraying with the Bordeaux mixture.

FLOWERING PEACHES AND PLUMS (*Prunus sp.*).—Nothing can be more beautiful than the double-flowering peaches and plums, but the flowers are of short duration and the trees subject to all the diseases and insects that attack the fruit-bearing trees, and are therefore not largely planted. They begin to bloom, however, in a few years from planting and where the expense can be afforded may be planted temporarily to occupy the space until more permanent or slower-growing trees can give the desired effect of shade or ornament.

FLOWERING APPLES.—While the blossoms of the apples are of short duration, like those of the plum, peach, and cherry, the tree is hardy and lasts a much longer time. Among the best of these are:

PARKMAN'S DOUBLE-FLOWERING (*Pyrus malus, var. Parkmanii*).—This is a rather dwarf tree with rich dark foliage and producing beautiful bright rose-colored double flowers.

CHINESE DOUBLE-FLOWERING APPLE (*P. m., var. flore roseo-plena*).—Flowers rather larger and more showy than the last.

LIQUIDAMBAR OR SWEET-GUM TREE (*Liquidambar styracifolia*).—A most beautiful tree of regular conical growth, fine dark foliage which takes on a beautiful red and yellow color in the autumn; a native of the middle and Southern States, but proves hardy in New England.

UMBRELLA-TREE (*Magnolia tripetala*).—Of a rather broad irregular form, its large leaves, often nearly 2 feet

long by 8 inches wide, and large showy white flowers make this tree a conspicuous object on the lawn. Like the tulip-tree and the other magnolias, its roots are soft and easily injured and must be treated very carefully in transplanting.

CUCUMBER-TREE (*M. acuminata*).—A very fine tree, pyramidal in form and producing yellowish fragrant flowers in considerable abundance. It thrives best in a deep warm soil.

SOULANGE'S MAGNOLIA (*M. Soulangiana*), Fig. 80.—This small tree is the most beautiful, most hardy and useful of the magnolias, the large cup-shaped blossoms of white and purplish color coming before the leaves making it a very conspicuous and beautiful lawn-tree.

SHOWY MAGNOLIA (*M. speciosa*).—Like the last, but with rather smaller and lighter-colored flowers that last somewhat longer.

SWAMP-MAGNOLIA (*M. glauca*).—A native tree found in swampy places from Maine to Georgia, and under favorable conditions is a great addition to our list of small trees. The foliage is bright green above and whitish beneath, and, like most of the small magnolias, is generally grafted on the tripetala stock. When grown in the shade of other trees, it holds its foliage nearly all winter.

Some others of the numerous species and varieties of magnolias succeed under favorable conditions, and where they thrive nothing gives more satisfaction.

MULBERRY (*Morus alba and rubra*).—The mulberry is a tree of good form, with bright green foliage that is ornamental, and many persons are fond of the fruit. The most hardy of the fruit-bearing and perhaps the best variety is the new American.

BOX-ELDER (*Acer negundo*).—A rather interesting tree



FIG. 80.—SOULANGE'S MAGNOLIA (*M. Soulangeana*).
(To face page 156.)

THE NEW YORK
PUBLIC LIBRARY

ASTOR, LENOX AND
TILDEN FOUNDATIONS.

with ash-like foliage and fruit much like that of the common maples. It soon takes an irregular form, is easily broken by wind or ice, and is rather short-lived.

CHINESE CORK-TREE (*Phellodendron amurense*).—A very desirable round-headed tree of recent introduction with foliage somewhat like the black walnut. Thus far it has proved clean and free from insects and disease.

YELLOW LOCUST (*Robinia pseudo-acacia*).—Were it not that this tree is attacked by insects which injure the branches, stopping their growth and causing the growth of suckers from the roots, it would be a great addition to the list of beautiful ornamental trees. Its foliage is fine and feathery, of a rich dark green color, and when in blossom we have no more beautiful tree. It is worthy of continued effort to find a remedy or preventive for the injury of insects, and it has been suggested that by spraying the trunk and main branches with Paris green and water or with this substance in the Bordeaux mixture, in the spring and early summer, this injury may be prevented.

WILLOWS.—Like the poplars, the willows are easily propagated by cuttings and will grow in almost any soil. They grow very rapidly, but soon reach maturity and are not of much value for permanent growth. Some of the weeping varieties are graceful and very ornamental and will be described under the head of Weeping Trees.

WHITE WILLOW (*Salix alba*).—The most rapid grower of all of the willows and often used to hold embankments and the soil along the borders of ponds and streams in place. While young it is regular in form and ornamental, but as it becomes older takes a more irregular growth and loses much of its beauty.

GOLDEN WILLOW (*S. a., var. vitellina*).—Of the same

form and habit of the white willow and possessing the same faults, but its golden bark in winter often forms a beautiful feature when planted among canoe-birches, red-twigged willows, or red dogwoods.

RED-TWIGGED WILLOW (*S. a. vitellina, var. Britzensis*).—This is a comparatively new variety with red twigs which while young are nearly as red as those of the red dogwood. It has not been widely tested, however.

BASSWOOD OR AMERICAN LINDEN (*Tilia Americana*).—A native tree of some value for ornamental purposes. It has large, dark green foliage and very fragrant white flowers suspended on long-winged peduncles in July. It makes a large tree in good soil, but becomes rather irregular as it reaches full growth.

EUROPEAN LINDEN (*T. Europea*).—A native of middle and northern Europe, of more regular form and smaller foliage than the last, and but for the injury caused by borers and a leaf-blight it would be one of the most valuable pyramidal trees. When not injured by the above pests, it grows very rapidly and reaches large size. (See chapter on Insects and Diseases.)

WHITE-LEAVED EUROPEAN LINDEN (*T. Europea, var. argentea*).—A vigorous tree with a more rounded head than the last and with leaves dark green above and silvery white beneath. Subject to the same pests as the last.

AMERICAN MOUNTAIN ASH (*Pyrus Americana*).—One of the most beautiful native small trees often found growing on our mountains. Its large cymose panicles of white flowers are very beautiful, and there is scarcely anything more beautiful than the large clusters of dark red fruit in the autumn and early winter. It is so seriously injured by the apple-borer, however, that it is only by the

most constant attention that it can be grown so as to reach large size.

EUROPEAN MOUNTAIN ASH (*P. aucuparia*).—Very similar to the last in habit of growth and foliage, but with larger and lighter colored berries. It requires the same treatment to prevent injury from insects as the last species.

OAK-LEAVED MOUNTAIN ASH (*P. a., var. quercifolia*), Fig. 81.—A very interesting form of the last species, of a



FIG. 81.—OAK-LEAVED MOUNTAIN ASH (*Pyrus aucuparia quercifolia*).

more compact habit, however, and having leaves somewhat like those of the English oak. Attention must be given this tree to prevent injury from borers.

HOP-TREE (*Ptelea trifoliata*).—This small round-headed tree possesses peculiar beauty of form and dark, rich color of foliage, but its most striking feature is the masses of

circular-winged fruit that somewhat resemble large clusters of the fruit of the common hop-vine.

OAKS.—These trees are, many of them, emblems of grandeur and strength, yet some of the species and varieties possess graceful and pleasing outlines and beautiful colors of foliage. In size many of them are not suited to small places, and yet a single large oak with a cottage and accompanying outbuildings nestling under its branches affords a most beautiful picture of comfort and protection of which the home is our best emblem. Perhaps the most objectionable feature of these trees as a lawn ornament is



FIG. 82.—WHITE OAK (*Quercus alba*).

the persistency with which the foliage adheres in the winter. In the grove mingled with evergreen and other deciduous trees this feature may have rather a pleasing effect, but in a conspicuous place on a lawn its persistent brown leaves are not a pleasing object for continued view during the winter. The oaks require a strong soil to reach their greatest perfection, but they do well under a great variety of conditions. They are difficult to transplant and need the special preparation recommended for the oak, black walnut, etc., on pages 140 and 141.

WHITE OAK (*Quercus alba*), Fig. 82.—The grandest of

all the oaks and one of the most common. It is rather slow in growth and wherever large trees are found, whether by the roadside or in the field, they should be preserved and the most be made of their picturesque grandeur.

RED OAK (*Q. rubra*).—See Street- or Avenue-trees.

SWAMP WHITE OAK (*Q. bicolor*).—Somewhat similar in appearance to the last, but rather more upright in growth and with a heavier foliage. It succeeds best in a moist soil.

PIN- OR SWAMP-OAK (*Q. palustris*), Fig. 83.—This beautiful oak is only of medium size and takes the most regular pyramidal form; the leaves are deeply lobed, dark green in color, changing to a beautiful scarlet-crimson in autumn. Its acorns are small, set in a very shallow cup, and the branches stand out nearly at right angles with the trunk or with age assume a drooping form. It is a tree that should be more planted than it is.

SCARLET OAK (*Q. tinctoria*, var. *coccinea*).—This tree resembles the red oak (see Avenue-trees) somewhat in outline, but with a much more deeply lobed leaf and an acorn of medium size nearly half immersed in the cup. It is an upland oak and takes on a beautiful scarlet color in autumn.

ENGLISH OAK (*Q. robur*).—This oak is medium to large in size, with rather small leaves like our native white oak, but more graceful and compact in outline. It takes a greater variety of forms than any other species, varying from the most close and upright pyramidal form to the low-spreading or weeping tree, and in foliage from the darkest green through the lighter shades of green to golden yellow and to the rich purple shades of the copper beech. In form of the leaves it varies from those with broad, almost

unbroken outline to the deeply cut, almost fern-like leaves. These peculiar and marked forms, however, must be propa-

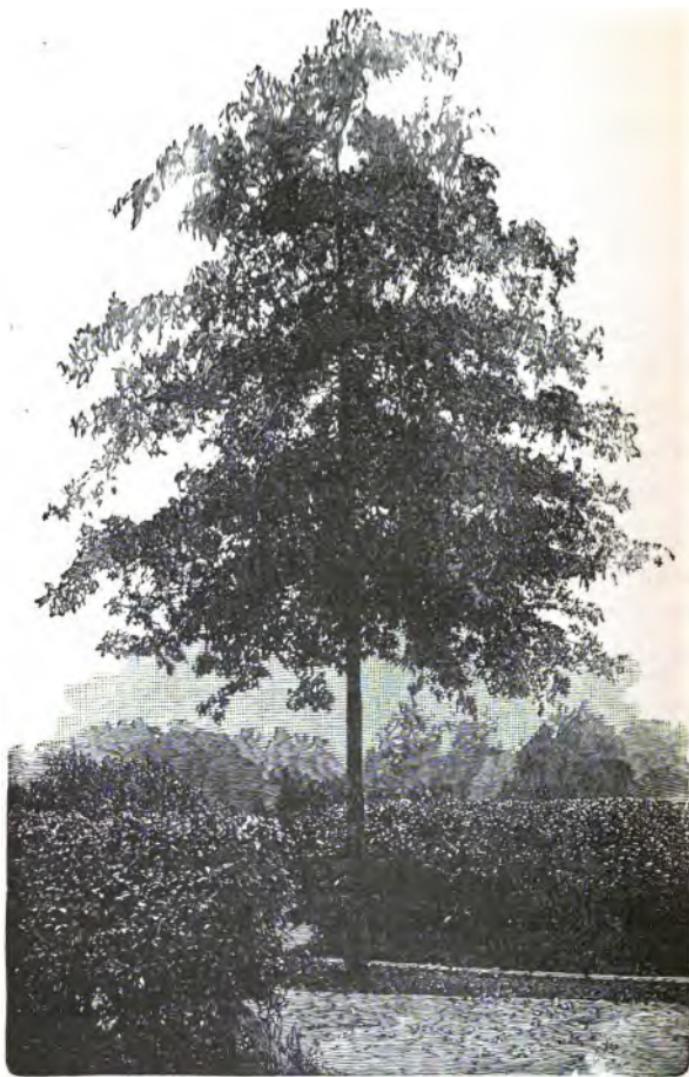


FIG. 88.—PIN-OAK (*Quercus palustris*).

gated by budding or grafting and are often of slow growth and expensive. Among the best forms are:

Fern-leaved oak (*Q. r.*, var. *asplenifolia*).

Variegated oak (*Q. r.*, var. *variegata*).

Purple-leaved oak (*Q. r.*, var. *atropurpurea*).

Pyramidal oak (*Q. r.*, var. *fastigiata*).

CHESTNUT OAK (*Q. Prinns*).—The leaves of this species are very much like those of the common chestnut, but not so narrow or so pointed. It succeeds best in rather strong rocky soil.

ELMS.—Under the heading of "Street-trees" the white and slippery elm were described. Both of these species are equally adapted to the lawn, where high-spreading forms are desired, but they are gross feeders and it will be found somewhat difficult to make other trees, shrubs, or plants grow near them. An abundance of plant-food, however, applied each fall will help to make both the elms and whatever may be planted among their roots grow satisfactorily.

ENGLISH ELM (*Ulmus campestris*).—Although of a sturdy, vigorous, upright growth, it does not reach the beauty and grandeur of our American elm. As with the English oak, this species takes many interesting forms, some of which are very beautiful.

SCOTCH ELM (*U. c.*, var. *Montana*).—Much like the last, but with a rather more upright and heavy growth.

All of the elms are subject to the attack of the elm-scale (*Gossyparia*), canker-worm, and the elm-beetle, which see on pages 270–274.

EUROPEAN LARCH (*Larix Europea*).—This is one of the most beautiful and rapid growing trees, and except when injured by the pine saw-fly, an insect the larvae of which destroy the foliage in the summer, and an aphis or plant-louse that sometimes checks its growth, is a most desirable

tree. The foliage is very fine and feather-like, and in the spring of the most delicate green color, which gives very beautiful effects in contrast with other foliage or by itself. It is easily transplanted and succeeds upon the poorest of soil. The lateral branches should be encouraged to make a full growth by heading in the top while young, yet at the same time its regular pyramidal habit of growth should be preserved.

Weeping Trees.

Few more beautiful objects can be seen than some of the many weeping trees that are now being offered by nearly all of our nurserymen. They possess beauty of form, grace in outline, and often produce beautiful flowers. They are especially adapted to planting upon the lawn. Most of the trees of this type are grafted upon other stocks, which in many cases results in a smaller or slower growth and adds very much to their cost.

LIST OF WEEPING TREES.

Maple, Cut-leaved Weeping.	Mulberry, Weeping.
Birch, Cut-leaved Weeping.	Willow, Babylon Weeping.
Cherry, Weeping Japanese.	" Kilmarnock Weeping.
Dogwood, Weeping.	" Thurlow's Weeping.
Beech, Weeping.	" Purple or Am. Weeping.
Ash, Weeping.	Elm, Camperdown.
Poplar, Weeping.	

CUT-LEAVED WEEPING MAPLE (*Acer dasycarpum, var. laciniatum*), Fig. 84.—A very graceful weeping tree with deeply cut leaves, dark green above and silvery white beneath. When allowed to grow without care, it often forms forked branches that are liable to split down with

heavy weight of snow and ice. To avoid this, only one leader or main branch should be allowed to grow at first, and all laterals tending to outgrow the leader should be headed in to keep a good balance of the tree. Some very fine trees are grown from seed of the cut-leaved varieties,

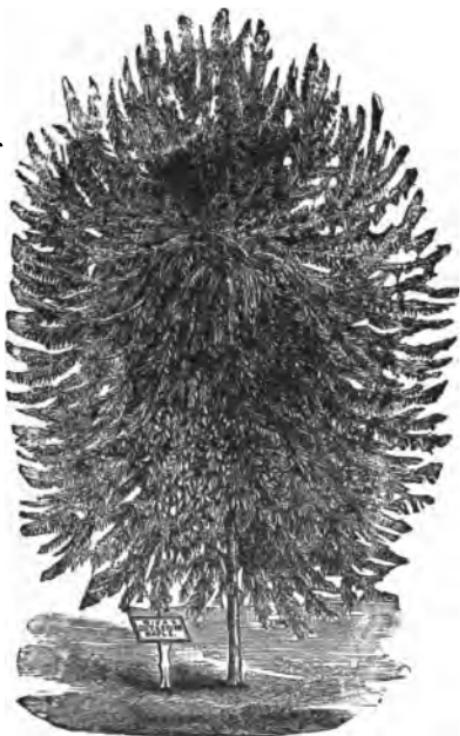


FIG. 84.—WIER'S CUT-LEAVED MAPLE (*Acer dasycarpum laciniata pendula*).

but the best forms must be obtained by grafting upon the common silver-maple stock.

CUT-LEAVED WEEPING BIRCH (*Betula alba, var. laciniata pendula*), Fig. 85.—On account of its rapid growth, the ease with which it is transplanted, and its great beauty, both in winter and summer, this is one of the most satis-

factory of the weeping trees. It is especially effective with a background of evergreens or in winter in contrast with red- or yellow-twigged willows. It grows well in poor soil



FIG. 85.—CUT-LEAVED WEEPING BIRCH (*Betula alba, laciniata pendula*).

and is easily transplanted while young, but not so readily when it reaches two or three inches in diameter. This variety is commonly grafted or budded on the common form of *B. alba*.

YOUNG'S WEEPING BIRCH (*B. a., Youngii*).—Smaller and less upright than the last, but with a mere drooping head and much smaller leaves. It forms a beautiful object on the lawn.

WEEPING CHERRIES AND PLUMS.—Nothing can be more beautiful than some of the double- and single-flowered weeping cherries and plums, but, like those of the same genus already described, they are short-lived, liable to injury from insects and fungous pests, and the cherries especially to injury to the trunk by freezing. One of the most beautiful is the

JAPANESE WEEPING CHERRY (*Prunus Japonica, pendula*).—While young this is one of the most beautiful objects ever introduced. It is, however, grafted upon an upright stock, and we have thus far found nothing as a stock that will withstand the climate of middle and northern New England, where the trunk is split open by the action of frosts. Further south it may not be injured in this way by severe winters.

WEEPING DOGWOOD (*Cornus Florida, var. pendula*).—This small tree is not more beautiful than the upright form of the species already described, but it is unique and attractive when well grown.

WEEPING BEECH (*Fagus sylvatica, var. pendula*), Fig. 86.—Although not regular in outline, this tree has a picturesque beauty peculiar to itself. It is vigorous in growth and desirable. Succeeds only on heavy soils.

WEEPING ASH (*Fraxinus excelsa, var. pendula*).—A rather stiff, drooping tree, with beautiful foliage, and although not equal in graceful beauty to many of the weeping trees it is useful in some combinations.

WEEPING POPLAR (*Populus grandidentata, var. pen-*

dula).—A most beautiful tree, producing its blossoms in long pendant catkins before any other trees are in bloom, and it makes a very beautiful object on the lawn. Its form is good, foliage rich green, free from disease, and grafted upon the Carolina poplar or cottonwood stock it bids fair



FIG. 86.—WEEPING BEECH (*F. syl., pendula*).

to be a tree that will last longer than some of the upright kinds. Its clean gray bark also makes it ornamental in the winter.*

WEEPING MULBERRY (*Morus alba, var. laciniata pendula*), Fig. 87.—One of the most graceful and beautiful fountain-shaped trees. Its branches are slender and fall away from the upright stock upon which it is grafted in a very graceful fountain-like manner, and its deeply cut and

* Since the above was written specimens of this tree have been seen badly injured by cold.

lobed bright green leaves add much to its lightness and beauty. It has thus far proved hardy and free from disease or insect pest.

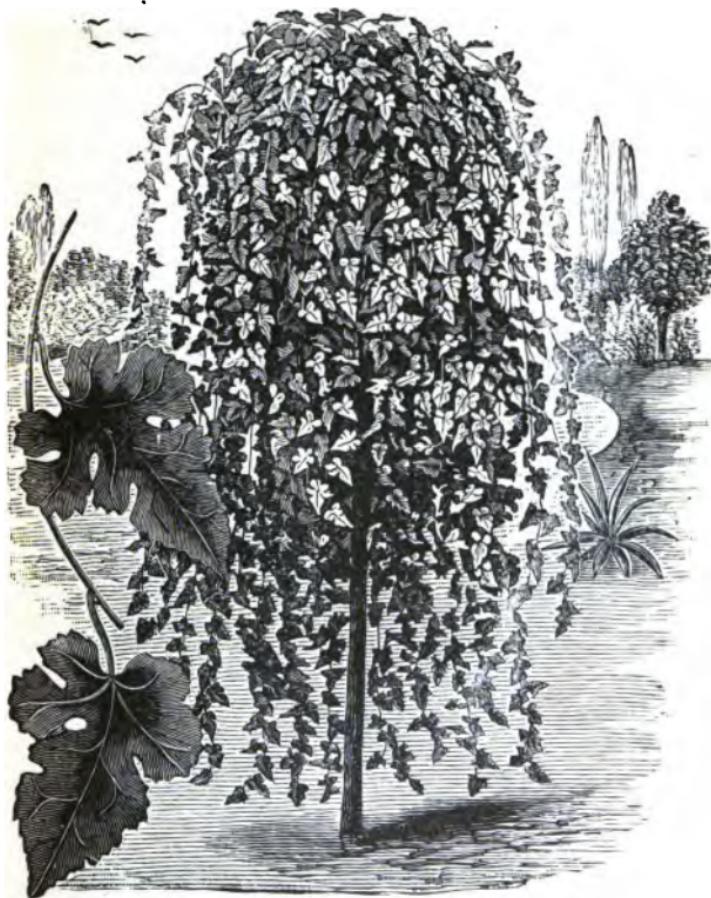


FIG. 87.—TEAS' WEEPING MULBERRY (*Morus alba, Siberica*).

BABYLON WEEPING WILLOW (*Salix Babylonica*).—The largest and most rapid growing of the very graceful weeping trees; it is a very beautiful tree, but has some of the faults of other species of willows, and its branches are easily broken off by wind and storm. It is especially adapted to

locations near water and grows most rapidly in a moist soil.

KILMARNOCK WEEPING WILLOW (*S. Capraea, var. pendula*).—This fountain willow grows well for a time in a great variety of soils, but is short-lived. Its form is very regular and unbroken, and is little more ornamental than a hay-stack.

THURLOW'S WEEPING WILLOW (*S. sp. Thurlowii*).—As far as tested this new tree promises to be the most satisfac-

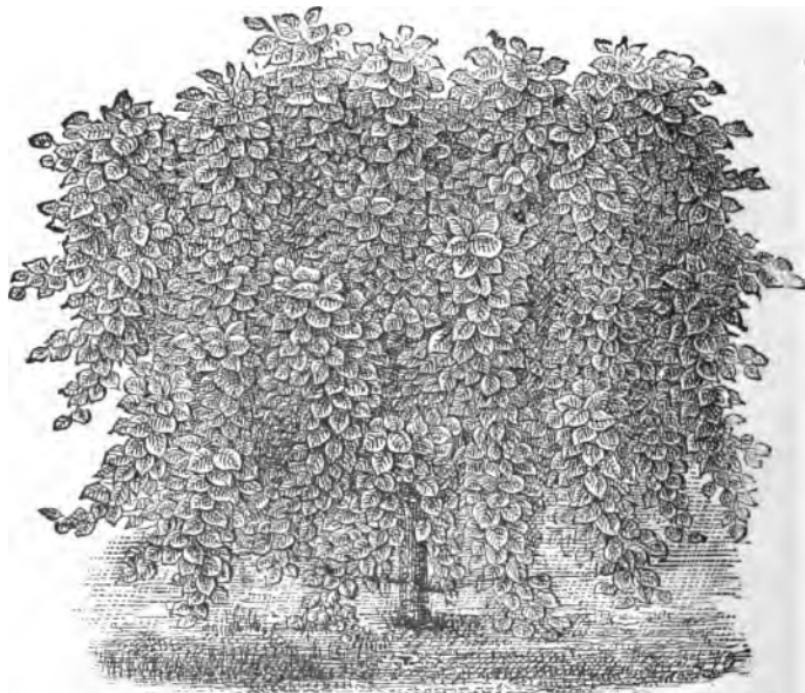


FIG. 88.—CAMPERDOWN ELM (*U. Campestris, pendula*).

tory and beautiful of the willows. In form it is upright with the branches bending toward the ground. Its branches are bright green, which will form a pleasing contrast with the yellow and red shoots of the other willows and the clean white branches of the birches.

PURPLE WEEPING WILLOW (*S. purpurea, var. pendula*).

—The glaucous foliage of this native willow, together with the purple-colored shoots, gives a shade of color that is very desirable in ornamental grouping.

CAMPERDOWN ELM (*Ulmus Montana, pendula*), Fig. 88.

—For an arbor-tree, one that will give a close shade and last a long time and is decidedly graceful in outline, this tree stands at the head of the list. To get the best results, it should be grafted at least six feet from the ground on the upright *Montana* stock; otherwise the branches will be too low to sit under conveniently, and when reaching near the ground many of the lower branches will soon decay.

Trees with Deeply Cut Foliage.

Maple, Wier's Cut-leaved.	Maple, Variegated-leaved, Jap.
Birch, Cut-leaved Weeping.	Beech, Fern-leaved, Jap.
Maple, Purple, Cut-leaved, Jap.	Ash, Cut-leaved " "
" Green Fern-leaved "	Oak, Cut-leaved " "

Of the above *Wier's Cut-leaved Maple* and *Weeping Cut-leaved Birch* have already been described under "Weeping Trees," Figs. 84 and 85, and are among the very best of this group.

JAPANESE MAPLES (*Acer polymorphum, var.*). — Few trees have such a variety of foliage or forms of growth as this species. Some of the most beautiful of the forms have already been mentioned, but no description given. Among the best are the following:

JAPANESE PURPLE CUT-LEAVED MAPLE (*A. p., dissectum purpureum*). — A beautiful weeping, cut-leaved, small tree, very slow in growth, but the leaves are so deeply cut and fern-like, and with deep purple color, that one is well repaid for considerable petting and long waiting if he

succeeds in making it grow to perfection. It must be planted in a deep, moderately rich soil, and should have an annual dressing of rich manure for 3 or 4 feet around the trunk in the fall.

JAPANESE GREEN FERN-LEAVED MAPLE (*A. p., var. pinnatifidum*).—A variety that is rather more vigorous than the last, but with green fern-like foliage and graceful drooping habit.

VARIEGATED FERN-LEAVED MAPLE (*A. p., dissectum roseo-pictum*).—Equal to the last in vigor and perfection of foliage, but many of the leaves are beautifully bordered and marked with white, pink, and rose-color, especially those on the inside of the shrub.

FERN-LEAVED BEECH (*Fagus sylvatica, var. heterophylla*).—In a heavy soil where other varieties of the beech succeed this tree will thrive and is very beautiful and desirable.

CUT-LEAVED ASH (*Fraxinus excelsior, var. culeata*).—The leaves of this variety are irregularly cut and divided and the tree presents a very pleasing appearance. Requires a heavy soil.

CUT-LEAVED OAK (*Quercus robur, var. laciniata*).—For a slow-growing tree this is one of the most permanent and in strong soil succeeds with good ordinary care. Like all the other oaks, it is difficult to transplant.

Trees with Colored Foliage.

Maple, Reitenbach.	Beech, Copper.
“ Schwerdler’s.	“ Rivers’ Purple.
“ Japanese.	Poplar, Golden.
“ Purple Sycamore.	Plum, Purple-leaved.
“ Tricolored Sycamore.	Oak, Purple-leaved.
Birch, Purple-leaved.	

REITENBACH MAPLE (*Acer platanoides*, var. *Reitenbachii*) and SCHWERDLER'S MAPLE (*A. p.*, var. *Schwerdlerii*) have already been described under Lawn-trees.

JAPAN PURPLE-LEAVED MAPLE (*A. polymorphum*, var. *atropurpureum* and *sanguineum*), Fig. 75.—These two varieties are very much alike, but the first has somewhat darker foliage with a deeper-lobed and rather narrower leaf than the last. They grow nearly as large as the common form of this species, i.e., 10 to 15 ft., and the foliage is the most beautifully colored of all of the purple-leaved trees. They require a deep warm soil, and perhaps a little shelter from too much exposure, and are more hardy when grown in the lawn than when grown in a rich border.

PURPLE SYCAMORE MAPLE (*A. pseudoplatanus*, var. *atropurpurea*).—A heavy, broad-headed tree, with dark bronze-green foliage, but not of the decided color possessed by Schwerdler's or the Japanese species.

TRICOLORED SYCAMORE MAPLE (*A. p.*, var. *tricolor*).—Of the same form as the last, but with leaves beautifully marked with white, green, and purple. Very interesting, but not a conspicuous tree.

PURPLE-LEAVED BIRCH (*Betula alba*, var. *atropurpurea*).—A tree of good form and with conspicuous colored foliage in spring, soon changing to a bronze green. The contrast of this dark foliage with the white bark of the branches makes it a very desirable tree. It succeeds upon very thin soil.

PURPLE-LEAVED CATALPA (*Catalpa bignonioides*, var. *purpurea*).—Were this tree perfectly hardy in the northern sections of the country it would be one of the most desirable trees for the lawn. It, however, is not quite hardy while young, and, as with the *C. speciosa*, it must be kept in the

shelter of the nursery until it is 3 or 4 inches in diameter at the base, when, if it has been transplanted in the nursery several times, it may be safely moved to the lawn, where it will succeed better than in a rich border. The foliage is large, dark bronze purple, growing somewhat lighter with the advance of the season.

COPPER-LEAVED BEECH (*Fagus sylvatica, var. purpurea*).—No tree is more conspicuous on the lawn or in groups than the purple or copper beech, and large numbers of them are planted each year; yet we see very few specimens more than a few years' old. The reason for this undoubtedly is that they do not succeed in all soils and in full exposure and that they are sometimes attacked by borers which work in the trunk near the ground. The varieties will grow only under the conditions of the common types, requiring a deep moist soil, some shade or shelter while young, and a cool northerly exposure.

RIVERS' PURPLE BEECH (*F. s., var. purpurea Riversii*), Fig. 89.—This variety has more deeply cut and darker leaves than the last, and may be preferred by many, though both are extremely beautiful, and change about equally to the bronze-green color as they mature.

GOLDEN POPLAR (*Populus Canadensis, var. aurea*).—This is the most rapid growing of the golden-leaved trees, and is of value planted in contrast with purple- and dark-leaved varieties of trees. Like some of the other species of poplars, it is short-lived and the leaves are often seriously injured by rust in August, which causes defoliation before the buds are matured. The treatment required to destroy this rust is the same as for that described for the black poplar.

PURPLE-LEAVED PLUM (*Prunus pissardi*).—Were it not

for the short life of this tree it would be one of the greatest acquisitions of the last decade. It is rapid in growth, easily

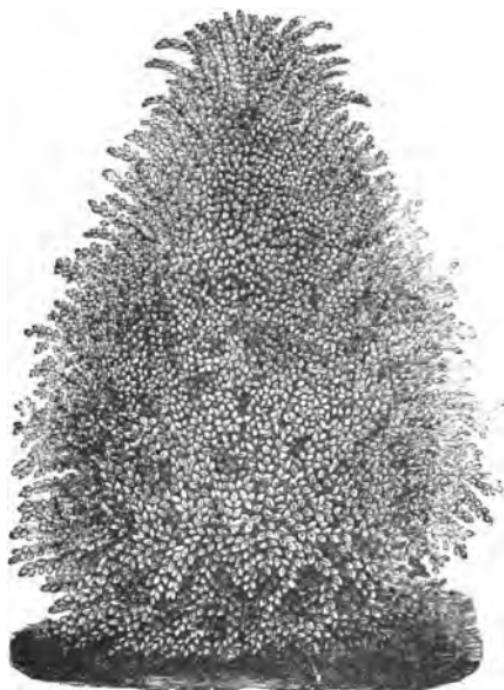


FIG. 89.—RIVERS' PURPLE BEECH (*Fagus syl., purpurea*)

transplanted, of good form, and retains its dark purple color longer than any other tree. As yet it has shown little tendency to disease or the attack of insects, and it is hoped that it may be free from some of the faults that render so many of the same genus of little value for ornamental purposes.

PURPLE-LEAVED OAK (*Quercus robur, var. atropurpurea*).—The characteristic of strength typified by the oaks makes any of the species of interest, and if in addition to this character they possess strikingly beautiful features they become all the more valuable. This tree has dark

purple or bronze-green foliage all summer, is moderately vigorous in growth, and very desirable.

GOLDEN-LEAVED OAK (*Q. r.*, *var. concordia*).—This is perhaps the best of the golden-leaved oaks, and is very beautiful when the leaves first unfold, but it loses something of its freshness and beauty as the season advances. Its chief value consists in the use that may be made of it in toning down the extreme shades and tints of other trees.

GOLDEN-LEAVED JAPANESE MAPLE (*A. Jap.*, *aurea*).—A most beautiful tree for planting with the purple-leaved forms of *A. polymorphum*.

CHAPTER XI.

EVERGREEN TREES.

EVERGREEN trees are indispensable in some features of ornamental gardening. They are especially valuable for screens and wind-breaks, for a background against which to group trees with beautifully colored leaves or branches, and for winter decoration. The too abundant use of evergreens results in a sombre effect and often to an unhealthy condition if planted too close to the buildings. The limit and scope of this work will allow of the description of only the most beautiful, and those that succeed under a wide range of conditions and are most easily transplanted. Small evergreens should not be planted where teams, persons, or animals passing will brush against them continually during the winter, as they are very easily injured in this way while frozen.

Evergreens may be transplanted at almost any season of the year, but great care needs to be taken that the roots do not become dry by exposure to sun and wind, and if possible a moist day should be selected. Evergreens, like all other trees and shrubs, must have an abundance of plant-food. The annual dressing of compost should be applied to them as much as to the flowering shrubs, at least until they have become thoroughly established. Nearly all are also benefited by pruning, especially those that tend to

grow into a close spiry form. This is best done in the spring before growth begins, though it may be done at any time with fair success. Among the best of the evergreen trees are:

Spruce, White.	Pine, Bhotan.
" Norway.	" Swiss Stone.
" Inverted Norway.	Cypress, Japanese Pea-fruited.
" Colorado Blue.	" " Thread-like.
Fir, Nordmann's.	Arbor-vitæ, American.
Juniper or Red Cedar.	" " Siberian.
" Prostrate.	" " Pyramidal.
Pine, Austrian.	" " Globe.
" Weymouth or White.	" " Golden.

WHITE SPRUCE (*Abies alba*).—A native tree of considerable beauty of form, rapid growth, and good color. It is easily transplanted and grows in a variety of soils.

NORWAY SPRUCE (*A. excelsa*).—The most rapid growing of the spruces and very beautiful while young, but after it reaches the age of 20 years and upwards its lower branches begin to fail and must be cut away. To prevent this in a measure severe heading in of the leader should be practised, which forces the growth into the lower branches. It grows rapidly even on very poor soil. The weeping variety (*A. e., var. inverta*) is very unique in form, the branches hanging downward close to the trunk, presenting a very unusual appearance.

COLORADO BLUE SPRUCE (*Picea pungens*), Fig. 90.—Seedlings of this most beautiful spruce vary very much in color, some being dark green, like the Norway spruce, while others are of the most beautiful glaucous or bluish-green color. Some of these very "blue" specimens may be found in every lot of seedlings, but to obtain them with certainty

and in large numbers scions are taken from the best-colored specimens and grafted into the ordinary "pungens" or "excelsa" stocks. Thus the most perfectly colored speci-



FIG. 90.—COLORADO BLUE SPRUCE (*Abies pungens*).

mens become rather expensive. They make most beautiful lawn-trees either singly or in groups of the same species or arranged with others of varying colors.

NORDMANN'S FIR (*Abies Nordmanniana*), Fig. 91.—A slow-growing tree of very dark green color and the most perfect pyramidal growth. The contrast of the new growth in the spring, which is almost golden color, with the very dark color of the old foliage is very beautiful.

RED CEDAR (*Juniperus Virginiana*).—A native tree generally conical in form, found growing on dry, rocky hillsides, and is very pretty and useful for decorating such places. It takes on more or less of the brownish green, like the arbor-vitæs, during the winter.

PROSTRATE JUNIPER (*J. sabina*, var. *procumbens*).—Although of rather coarse growth, its prostrate habit makes it valuable for decorating rocky grounds, among ledges and

boulders, where it is very effective. The golden variety, the new growth of which is of golden color, is very pretty in contrast with the dark green of the original form.



FIG. 91.—NORDSMANN'S FIR (*Abies Nordmanniana*).

AUSTRIAN PINE (*Pinus Austriaca*), Fig. 92.—This is rather a heavy growing-tree, somewhat resembling our native pitch-pine, but with a more compact growth, longer and darker green leaves, and succeeds in a variety of soils. The most valuable of the hard pines for ornamental purposes, but should not be planted on small places.

WHITE OR WEYMOUTH PINE (*P. strobus*).—This is one of the most valuable native trees for a quick growth, growing rapidly in almost any kind of soil. While young it is very beautiful, perfect in outline, and of a beautiful

glaucous color, but as it reaches maturity it becomes more and more spreading and irregular, which while not unpleasant under some circumstances is not well adapted to use upon the ordinary small lawn. It is one of the most



FIG. 92.—AUSTRIAN PINE (*Pinus Austrica*).

easily transplanted trees we have, whether taken from the nursery, the pastures, or woods. It stands pruning well and may be trained into a great variety of forms, though in its natural growth while young it possesses more real beauty than any close-shaven or unnaturally trained form.

BHOTAN OR LONG-LEAVED PINE (*P. excelsa*).—Some-

what resembling the last, but with much longer and more beautiful leaves; the form of the tree, however, is not so graceful or regular. Not quite hardy in the Northeastern States.

SWISS STONE-PINE (*P. cembra*).—This species is very much like the native white pine in color, but it is more compact in form, making a pyramidal growth. It is rather



FIG. 93.—JAPANESE PEA-FRUITED CYPRESS (*Retinospora picifera*).

slower in growth than the latter species and much more beautiful.

JAPANESE PEA-FRUITED CYPRESS (*Retinospora picifera*), Fig. 93.—This is the largest and one of the most hardy of the many species of this genus that have been introduced from Japan. The foliage is dark green and it is somewhat

fern-like in the arrangement of its small branches. While young it is compact and very beautiful, but as it reaches maturity it becomes more open and irregular in growth, though it still retains much of its beauty.

JAPANESE THREAD-LIKE CYPRESS (*R. filifera*).—More beautiful than the last and equally hardy. It is of light green color with thread-like terminal branches and very graceful and perfect in form. One of the most desirable of evergreens of medium size.

AMERICAN ARBOR-VITÆ (*Thuya occidentalis*).—A native tree of beautiful form and color while young, but soon becomes irregular and tends to lose its lower branches as it increases in age. It has produced a great many beautiful forms, some of which are much more valuable than the original type. It should not be planted where there is very great exposure to prevailing winds or where teams, persons, or animals will come in contact with it during the winter when the branches are frozen, for nothing is more destructive to its beauty than contact in zero weather. Among the most valuable varieties are the following:

SIBERIAN ARBOR-VITÆ (*T. o., var. Siberica*), Fig. 94.—Compact, dwarf, conical in form, of a much darker green than most of the varieties, and it takes on less of the brown color during the winter than any other form of the species; especially valuable for hedges.

PYRAMIDAL ARBOR-VITÆ (*T. o., var. pyramidalis*).—Of close, compact, pyramidal form, it serves a good purpose where small columnar trees are desired. It is of about the same color as the original type of the species.

GLOBE ARBOR-VITÆ (*T. o., var. globosa*).—Compact and globular in form, of a dark green color, and valuable for low hedges or for small, low, round-headed trees.

GOLDEN ARBOR-VITÆ (*T. o.*, var. *aurea*).—Several varieties with golden-tipped branches or with the whole foliage of a very light green color are offered by nursery-

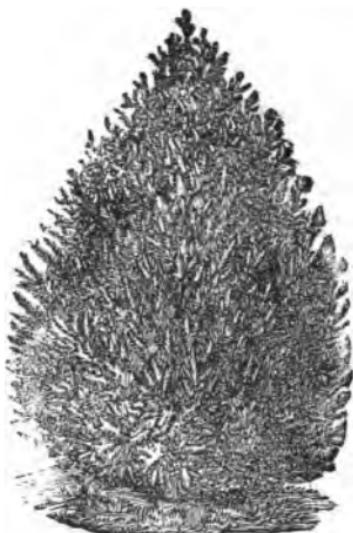


FIG. 94.—SIBERIAN ARBOR VITÆ (*Thuya occidentalis, var. Siberica*).

men, and planted in contrast with dark green varieties they produce a very pleasing effect. Perhaps one objection may be urged against them, as with other trees with yellow foliage, that they have the appearance of sickly trees, but when properly grouped they may be made to tone down sharp contrasts and to add tints to groups not otherwise obtainable.

CHAPTER XII.

ORNAMENTAL SHRUBS, CLIMBING VINES, AND HEDGE PLANTS.

FLOWERING shrubs and those with brilliantly colored foliage are to ornamental gardening what the finishing touches are to the picture or the varnishing is to furniture. They help to fill out the well-rounded forms of groups of trees and, possessing more variety of colors of flowers and foliage than the large trees, they add beautiful bits of color to often otherwise tame garden-work. Being small in size, they are especially useful in planting places of small extent, are comparatively inexpensive, and reach maturity in a very short time. They are very useful in ornamenting the foreground where it is desired to take in views above and beyond the limits of small grounds, and serve the purpose of a setting or ornamentation close up to the dwelling and over which may be viewed the more extended lawn decoration. Among the most desirable are the following:

Azalea, Pink.	Pepper-bush, Sweet.
" Flame-colored.	Dogwood, Red-twiggled.
" Vasey's.	" Variegated
" Japanese.	Filbert, Purple-leaved.
" Ghent.	Quince, Japanese.
Aralia, Hercules-club.	Daphne.
" Japanese.	Deutzia, Double-flowered.
Barberry, Am.	" Slender.
" Dwarf.	Weigela, Rose-flowered.

Weigela, Variegated.	Elder, Red-fruited.
Silver-thorn.	Spiræa, Golden.
Strawberry-tree.	" Bridal-wreath.
" " Corky-barked.	" Lobed.
Exochordia.	" Bumalds.
Golden-bell.	" Thunbergs.
" " Fortune's.	" Van Houtts.
" " Weeping.	Snowberry.
Silver-bell	Indian Currant.
Rose of Sharon.	Lilac, Common.
Hydrangea, Japanese.	" Persian.
St. John's-wort, Shrubby.	" Japanese Tree.
Honeysuckle, Tartarian.	" Josikea.
Mock-orange.	" Downy.
" Golden.	Cranberry-shrub.
" Large-flowered.	Snowball, Japanese.
Purplefringe (Smoke-tree).	Roses, Bedding.
Whitefringe	" Moss.
Sumac, Cut-leaved.	" Climbing.
" Japanese.	" Japanese.
Elder, Golden.	Rose, Japanese Running.

PINK AZALEA (*Azalea (Rhododendron) nudiflora*).—One of the most beautiful of our native shrubs and one that succeeds best in rather cool, shaded places. It is easily transplanted and may be very successfully moved from the borders of woods to the lawn if taken in clumps with something of a bog of soil upon the roots. The plants are improved, however, if taken up and grown in a cool, somewhat shaded nursery for a year or two before transplanting permanently.

FLAME-COLORED AZALEA (*A. (R.) calendulacea*).—A beautiful species from the mountainous regions of the South and requiring a little protection in New England, but well worth the little care required to protect it by setting up pine boughs about them or by tying up in a thin covering

of straw or mats during the winter. It succeeds under the same treatment as the last.

VASEY'S AZALEA (*A. (R.) Vaseyii*).—A comparatively new species, also a native of the Southern States, with beautiful light pink or rose-colored flowers, and thus far has proved hardy. It promises to be a valuable addition to our list of early-blooming shrubs.

JAPAN AZALEAS (*A. mollis*), Fig. 95.—The flowers of this species are of a great variety of colors, ranging from almost pure white through various shades of yellow and



FIG. 95.—JAPANESE AZALEA (*Azalea mollis*).

orange to that of dark orange-red. It is perfectly hardy, but rather slow in growth, requiring a moist soil and a little shelter from drying winds and hot sun.

GHENT AZALEAS (*A. pontica, hybrida*).—The flowers of this species are very similar in colors to the last and require about the same treatment.

HERCULES'-CLUB (*Aralia spinosa*). — An interesting shrub, with large compound leaves and a heavy panicle of white flowers coming in August. It has the habit of producing suckers that, if left to themselves, are not desirable,

but by pulling up such as are not wanted those remaining grow luxuriantly and the mass is kept in a satisfactory condition. It succeeds best in a somewhat sheltered, warm, but rich soil.

JAPANESE ARALIA (*A. Japonica*).—This species resembles the last very much, but with rather smaller and finer leaves, requiring the same treatment.

AMERICAN BARBERRY (*Berberis vulgaris*), Fig. 96.—This beautiful shrub is common throughout the Eastern and Northern States, and were it less common would be more prized as an ornamental shrub. It grows with little care and no shrub is more beautiful, with its golden drooping



FIG. 96.—BARBERRY (*Berberis vulgaris*), Fruit.

clusters of flowers in June and its bright scarlet fruit in autumn and winter. It has the tendency to make a rather straggling bush, but may be forced to take a compact bushy form by heading back severely some of the strong new shoots on the inside when they have reached the height of 2 or 3 feet. It makes a very desirable hedge.

PURPLE-LEAVED BARBERRY (*B. v., var. purpurea*).—One of the smallest purple-leaved shrubs and one of the best. It retains its dark purple color through the season better than almost any other tree or shrub, and is especially desirable to plant in the foreground of golden or light green leaved trees or shrubs. Its golden flowers are rather more

conspicuous on the dark purple background of its leaves than those of the common type, but the fruit is not so conspicuous. It needs frequent heading in while young to bring it into a compact bushy form.



FIG. 97.—SWEET PEPPER-BUSH (*Clethra alnifolia*).

DWARF BARBERRY (*B. Thunbergii*).—A beautiful dwarf shrub from Japan, not growing more than 3 feet high, and taking a broad compact form. Its leaves are small and numerous, changing to a beautiful orange and red color in the autumn, and the fruit, about the same size as the native species, is borne singly along the under side of the drooping

branches. It is especially desirable for low hedges, lines, or borders.

SWEET PEPPER-BUSH (*Clethra alnifolia*), Fig. 97.—A very hardy native shrub, producing abundant spikes of beautiful fragrant white flowers in July. It has the habit of spreading by sucker and needs care that too many of these are not allowed to grow; otherwise the flowers will be small and less abundant. It thrives best in a rather moist, somewhat shaded locality.



FIG. 98.—VARIEGATED DOGWOOD (*Cornus Siberica, variegatus*).

RED DOGWOOD (*Cornus sanguinea*).—A beautiful shrub of large size and especially valuable for winter effect. The branches are bright red, and planted in contrast with low-trained golden willow with the snow for a background very

beautiful results are often obtained. A group of evergreens in front of this shrub also gives a good contrast.

VARIEGATED-LEAVED DOGWOOD (*C. Siberica, variegata*), Fig. 98.—The leaves of this shrub are most beautifully variegated with yellow, white, and green, and make pleasing contrasts with dark green or purple leaved shrubs. The branches are of the same color as those of the last.

PURPLE-LEAVED FILBERT (*Corylus avellana, var. atropurpurea*).—This shrub has the darkest foliage of any that I am acquainted with. When it first unfolds it is almost black, but it soon changes to a rich bronze green. It is one of the best for planting in contrast with the golden-leaved elder, golden spiraea, the variegated dogwood, or other shrubs with bright-colored foliage. It should not be forced too rapidly while young, as it is not quite hardy in the extreme Northern States. A purple form of the common hazelnut, *C. Americana*, has recently been discovered by the author but has not been put on the market. From its hardiness, ease of growth, and beautiful foliage it promises to be one of the best purple-leaved shrubs.

JAPAN QUINCE (*Cydonia Japonica*), Fig. 99.—One of the most hardy and vigorous of the imported shrubs. The flowers are mostly scarlet, but varying from this through many shades of red and pink to pure white, and as they open before the leaves unfold produce very brilliant effects. Its tough, hard growth makes it valuable for hedges, which are very ornamental when in blossom.

DAPHNE (*Daphne mezereum*).—This is the earliest bloomer of all flowering shrubs, and its close clusters of dull pink flowers, though not very large or showy, are very pretty harbingers of spring.

DOUBLE-FLOWERED DEUTZIA (*Deutzia crenata, fl. pl.*).—

A tall, upright-growing shrub with dark green leaves and pendent racemes of pink or white flowers. It tends to grow with few lower branches, and some of the inside canes need cutting out occasionally to give it a branching condition. If forced into too much growth it often winter-kills.



FIG. 99.—JAPAN QUINCE (*Cydonia Japonica*).

SLENDER DEUTZIA (*D. gracilis*).—One of the most beautiful small shrubs with delicate white flowers in abundant racemes. Like the last, it should be grown rather slowly or it will be injured during the winter. A slight protection of pine boughs or straw will improve the size and quantity of the flowers.

ROSE-FLOWERED WEIGELA (*Diervilla rosea*), Fig. 100.—While young this beautiful shrub is very satisfactory, but

after a few years' growth it becomes irregular in outline. To overcome this tendency some of the old wood should be



FIG. 100.—WEIGELA (*Diervilla rosea*).

cut out each year after flowering, which will result in the growth of young vigorous shoots that will produce an abundance of large flowers.

VARIEGATED-LEAVED WEIGELA (*W. rosea, variegata*).—The leaves of this variety are beautifully marked with

white, yellow, and light green; not so rapid in growth as the last and the flowers are of a lighter color.

Several other species and varieties are offered by the nurserymen, but none of them are more valuable than the above.

SILVER-THORN OR OLEASTER (*Eleagnus longipes*).—A comparatively new ornamental shrub with fruit of a bright red color which is very ornamental. It ripens in July and August and hangs a long time on the bushes. It is almost perfectly hardy, easily transplanted, and seems to succeed in almost any soil.



FIG. 101.—EXOCHORDA GRANDIFLORA.

STRAWBERRY-TREE (*Euonymus atropurpurea*).—A tall-growing shrub or small tree with rich dark green foliage and a showy fruit, the outer part of which is crimson while the inner part is scarlet. This fruit hangs upon the bush nearly all winter unless eaten by birds.

CORKY-BARKED STRAWBERRY-TREE (*E. alatus*).—More compact and bushy than the last and with a richer foliage, but does not produce so much fruit.

EXOCHORDA (*Exochorda grandiflora*), Fig. 101.—One of

the best of the recently introduced shrubs. The foliage is of a glaucous green color and the flowers are single, pure white, and borne in large clusters and masses. It is hardy, very showy, and free from disease and insects.



FIG. 102.—GOLDEN-BELL (*Forsythia viridissima*).

GOLDEN-BELL (*Forsythia viridissima*), Fig. 102.—The brightest and most attractive of the very early flowering shrubs. The flowers are of the brightest yellow and produced all over the young branches. The shoots are per-

fectly hardy, but in seasons when the peach-buds are destroyed by cold the flower-buds suffer and at the North fail to produce flowers.

FORTUNE'S GOLDEN-BELL (*F. Fortunii*).—Produces more abundant and larger flowers than the last.

WEEPING GOLDEN-BELL (*F. suspensa*).—Is pendent or weeping in habit and with very abundant flowers. In many places where a drooping growth is desired this is much superior to the other species.

SILVER-BELL (*Halesia tetrapeta*).—A beautiful shrub producing pure white bell-shaped flowers much like the snowdrop, whence its name.

ROSE OF SHARON (*Hibiscus Syriacus*).—This shrub, while not perfectly hardy north of New York City, is valuable on account of its large showy flowers, which open in August and September. If grown slowly in the border or lawn, it lives to considerable age and makes a very large shrub or small tree. The flowers vary in color from pure white to the darkest crimson and with many beautiful varieties of striped or mixed colors.

JAPANESE HYDRANGEA (*Hydrangea paniculata, grandiflora*), Fig. 103.—Of the many beautiful shrubs introduced from Japan this is one of the best, most easily grown, and largely planted. The flowers, coming in August and September, are very large and showy and last a long time. If gathered at just the right stage of growth the flowers retain their beauty and freshness for a long time and make desirable decorations during the winter. To get the best results in growing this shrub, the new growth should be cut back severely in the fall or before growth begins in the spring, in many cases to two or three buds, for the smaller the number of buds allowed to grow the stronger the

shoots, and the size of the panicles will be in proportion to the vigor of these shoots.

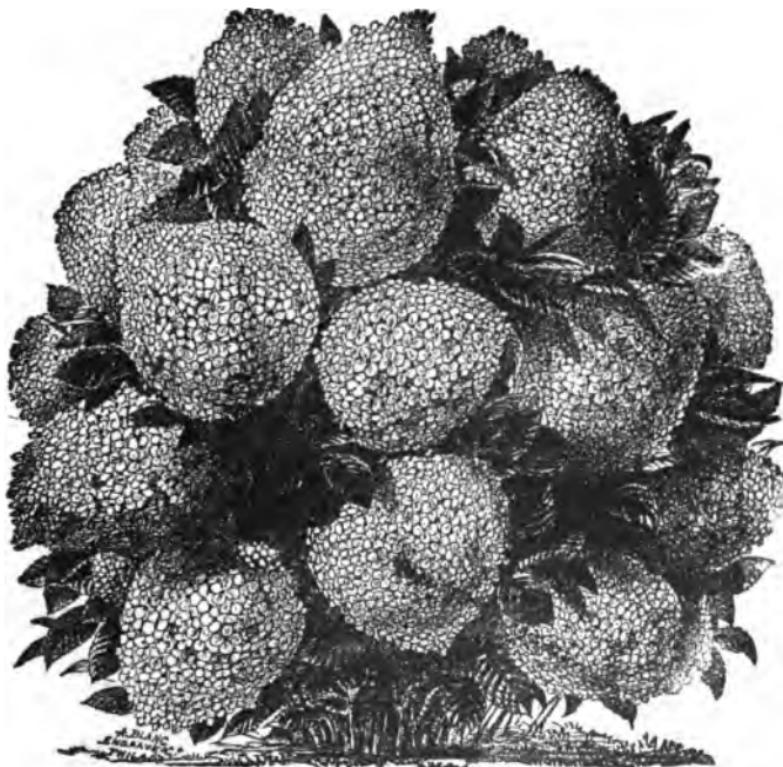


FIG. 103.—HARDY HYDRANGEA (*Hydrangea Paniculata, grandiflora*).

SHRUBBY ST. JOHN'S-WORT (*Hypericum aureum*).—One of the most beautiful of the flowering shrubs, the flowers being like little tassels of gold and the foliage of a rich glaucous green. It is not, however, a long-lived shrub, requiring considerable pruning after five or six years of growth.

TARTARIAN HONEYSUCKLE (*Lonicera Tartarica*).—Some of the more brilliantly colored flowered varieties of

this species are very desirable. It makes a very large, upright shrub, with pink or yellow blossoms that are followed by bright scarlet berries.

CALYCANTHUS, sweet-scented shrub; strawberry-bush, etc. (*Calycanthus Floridus*), Fig. 104.—A very hardy, vigorous-



FIG. 104.—CALYCANTHUS (*Calycanthus Floridus*).

growing shrub with brown or chocolate-colored very sweet-scented flowers. It is easily propagated from seed, which it produces abundantly, and grows well on almost all kinds of soil; not a showy shrub, but desirable for the fragrance of its flowers.

MOCK-ORANGE (*Philadelphus coronarius*), Fig. 105.—Often called the syringa, but as this is the Latin name of the lilac it cannot be properly applied to this plant. It is well called the mock-orange, for its flowers somewhat resemble the orange-blossom, and are equally fragrant, though with not so delicate a perfume. It grows to a large size, but retains its regular rounded bush form even when of great age.

GOLDEN-LEAVED MOCK-ORANGE (*P. c., var. aurea*).—Very similar in leaf and flower to the last, but of a smaller

growth, and with leaves that are of a bright golden color when young, but changing to a light green during the latter part of the summer. In contrast with the purple



FIG. 105.—MOCK-ORANGE (*Philadelphus coronarius*).

barberry, purple filbert, or other similarly colored foliage-shrubs it produces most beautiful effects.

LARGE-FLOWERED MOCK-ORANGE (*P. grandiflorus*), Fig. 106.—A shrub of large, coarse growth, producing conspicuous single, white, non-odorous flowers the last of June.

WHITE-FRINGE (*Chionanthus Virginicus*), Fig. 77.—One of the most beautiful of our flowering shrubs, with its somewhat stiff upright branches fringed with lace-like white flowers. Its blossoms last but a short time, but the heavy dark green foliage is ornamental all summer. If planted in too rich soil it is sometimes winter-killed, and should be grown rather slowly to cause a more thorough ripening of the wood.

PURPLE-FRINGE (*Rhus cotinus*), Fig. 107.—The beautiful mass of filaments produced about the flowers and fruit



FIG. 106.—MOCK-ORANGE, LARGE-FLOWERED (*Philadelphus grandiflorus*).



FIG. 107.—PURPLE-FRINGE (*Rhus cotinus*).

of this plant, often called "smoke" or "mist," is a most conspicuous and beautiful object in well-grown specimens on the lawn or in the garden. To succeed best it must be grown slowly; if forced into a rapid growth in a rich border it is likely to be injured by cold and soon die, while if grown more slowly in the lawn it often reaches a large size, when it becomes a most beautiful object.

CUT-LEAVED SUMAC (*R. glabra, var. laciniata*).—This is a cut-leaved form of our native smooth sumac. It takes a rather straggling form and needs full exposure to make it grow stocky and erect. It has one objectionable feature common to all of the native species of sumacs,—that of throwing up suckers from the roots, and often at considerable distance from the original shrub,—but this objection can be easily overcome by pulling up the suckers (never cut them off at the surface). Its beautiful fern-like leaves that color so brilliantly in the autumn make it well worth all the care required to keep it in good form and within desired limits.

JAPAN SUMAC (*R. Japonica, var. Osbeckii*).—A very large, strong-growing shrub or small tree, with large compound leaves changing to beautiful colors in the autumn. The panicles of flowers are very large, nearly pure white, and open very late in the summer.

GOLDEN ELDER (*Sambucus nigra, var. aurea*).—One of the brightest golden-colored shrubs, the leaves retaining their bright color longer than almost any other. It is, however, rather short-lived.

RED-FRUITED ELDER (*S. pubens*).—A native shrub, ornamental both in flower and in fruit. Berries in large clusters and bright red.

GOLDEN SPIRAEA (*Spiraea opulifolia, aurea*).—The largest

golden-leaved shrub we have, but of rather coarse growth and the leaves soon fade to a light green. Desirable as a background for smaller shrubs of a darker color.



FIG. 108.—BRIDAL-WREATH (*Spiraea prunifolia*).

BRIDAL-WREATH SPIRÆA (*S. prunifolia*), Fig. 108.—One of the oldest and most hardy of the spiræas and very

largely planted. It produces long, slender branches that in the spring are covered with beautiful white double flowers. These branches may be bent around so as to form a very perfect wreath, whence the name. It has the habit of producing very few lateral branches, so that severe pruning should be given to a few of the strongest canes after blooming in the spring. Never prune the spiræas in the spring before blooming if an abundance of flowers is desired. Like all the other species of this genus, the flowers last but a short time.

LOBED-LEAVED SPIRÆA (*S. trilobata*).—A dwarf, compact grower, producing large masses of white flowers.

BUMALD'S SPIRÆA (*S. Japonica, var. Bumalda*).—A dwarf-growing shrub, with large quantities of rose-colored flowers.

THUNBERG'S SPIRÆA (*S. Thunbergii*).—The most graceful and beautiful of the spiræa while young. The foliage is fine and fern-like, and changes to a beautiful golden-orange color late in the autumn. It needs cutting back severely to cause the lower branches to grow with vigor.

VAN HOUTT'S SPIRÆA (*S. Van Houttii*), Fig. 109.—The finest of all the spiræas. It is dwarf in habit, with graceful pendulous branches that, when in bloom, are weighted down with pure white blossoms. The flowers are of very short duration, but the foliage is good.

WATERER'S SPIRÆA (*S. Jap., var. "Anthony Waterer"*).—Resembling the Bumalda, but with the most beautiful large clusters of pink flowers, and continues to bloom throughout the summer more or less if the clusters are cut off before the seed-vessels mature.

SNOWBERRY-SHRUB (*Symporicarpus racemosus*).—A

very pretty old-fashioned shrub, the white berries of which are ornamental until early winter and especially in contrast with the fruit of the closely allied species *S. vulgaris*, the Indian currant, or that of the barberry.



FIG. 109.—VAN HOUTT'S SPIRÆA (*Spiræa Van Houttii*).

COMMON LILAC (*Syringa vulgaris*).—This is a very desirable shrub because of its hardiness and the many associations connected with the old homesteads of the earlier settlers of the country. Many of the improved varieties possess more beauty than the original types and are equally hardy. Among the best are Beranger, *cœrulea superba* and *nana*, Prof. Sargent, etc.

PERSIAN LILAC (*S. Persica*).—This lilac is of medium size, with small, bright green leaves and large compound panicles of rather brighter flowers than the common species. It is also rather more graceful in outline than the latter and, like it, has a great many varieties. Among the best are the white form and *Rothmagensis rubra*.

JAPAN LILAC (*S. Japonica*).—The largest of the lilacs, making a small tree. The leaves are large, dark green, and the very large panicles of white flowers are produced in

June. It has thus far proved perfectly hardy and is desirable.

JOSIKEA'S LILAC (*S. Josikœa*).—Another tree-like lilac, somewhat resembling the last, but producing delicate pink flowers in early June.

DOWNY LILAC (*L. villosa*).—A new species of a somewhat tree-like habit, with fragrant light purple flowers which change to almost white.



FIG. 110.—JAPANESE SNOWBALL (*Viburnum plicatum*).

CRANBERRY-SHRUB (*Viburnum opulus*).—A native shrub with numerous conspicuous sterile flowers intermixed with the fertile ones, followed by bright red or scarlet fruit that hangs on the branches nearly all winter. It is hardy and succeeds under nearly all conditions. The variety with all sterile flowers is known as the “common snowball”-bush,

but this is so subject to the attack of insects that it has been discarded for the Japanese species.

JAPANESE SNOWBALL (*V. plicatum*), Fig. 110.—The leaves of this shrub are of a bright green color and with a beautifully plicated or plaited surface; the sterile flowers are borne in large clusters, are pure white, very perfect, and much superior to the native snowball-bush. It is difficult to transplant when of large size, but young shrubs can be transplanted with little or no difficulty.

Roses.

More people appreciate the beauty and value of the rose than that of any other flower, but comparatively few succeed in growing it to its greatest perfection. It succeeds best in a deep rich soil, rather moist and of somewhat a clayey nature. More persons fail in growing the rose from not making the soil rich enough than from any other cause.

Perhaps the best line of treatment is to spade the bed 18 to 24 inches deep, working in fine rotted cow manure and leaf mould to the full depth, and every fall banking up against each plant a foot or more with rich stable manure for protection. In the spring this manure should be spread on the surface of the bed and spaded in, and if the soil is not too thin and dry a good growth and an abundance of blossoms will result.

PRUNING.—In pruning the work may be done either in the fall or in March, the latter time being generally preferred. In this work the bushes should be so pruned as to obtain a limited number of as strong canes as possible. The stronger the canes the larger will be the flowers. All weak shoots should be either severely cut back or entirely removed and the strong canes headed back one half or two

thirds, varying the treatment somewhat with the variety and the size and number of flowers required; some varieties, especially the very strong growing ones, needing less pruning than others, but with all varieties the smaller the number of shoots the larger will be the flowers.

WINTER PROTECTION.—Banking up against the collar of the bushes a foot or more with soil or manure should be practised with all outdoor roses, and most of them will be much benefited by tying up in coarse rye-straw or mats. Pine boughs set up closely about them for the winter will improve the quality of the blossoms very greatly.

VARIETIES.—We may divide the varieties most commonly grown and most desirable into six groups: *bedding-roses*, *hybrid perpetuas*, *moss*, *climbing*, *Japanese*, and *yellow* or *Austrian* roses. It is impossible to give a list of varieties that will succeed in all localities or under all conditions, and each grower must decide largely what varieties will be the most satisfactory for him by the success of growers in his immediate vicinity. We, however, give a list that will prove valuable under a great variety of conditions.

BEDDING-ROSES, Fig. 111.—*Bride*, *Bridesmaid*, *Etoile de Lyons*, *La France*, *Md. Plantier*, *Meteor*.

HYBRID PERPETUALS.—*Anne de Diesbach*, *Chas. Le-feuvre*, *Gen. Jacqueminot*, *Mabel Morrison*, *Marie Beau-man*, *Marshall P. Wilder*, *Mrs. John Laing*, *Prince C. de Rohan*, *Ulrich Brunner*, *Victor Verdier*.

MOSS-ROSES, Fig. 112.—*Common Moss*, *Crested Moss*, *Adelaide*, *White Bath*.

CLIMBING ROSES, Fig. 113.—*Baltimore Belle*, *Queen of Prairie*, *Crimson Rambler*.

JAPAN ROSES, Fig. 114.—*Rosa rugosa* (*white and red*), *R. Multi-flora*, *Dawson's*, *R. Wichuriana*.



FIG. 111.—BEDDING-ROSES.



FIG. 112.—MOSS-ROSE.

YELLOW OR AUSTRIAN.—These beautiful roses are not long-lived and require careful pruning to produce an abundance of blossoms. Only the weak shoots should be cut away, leaving the strong shoots of one and two seasons'



FIG. 113.—CLIMBING ROSES.

growth for the production of flowers. The two varieties most commonly grown are the Austrian and Harrison.

Evergreen Shrubs.

If we should omit the evergreen shrubs from our list of ornamental material, we should lose much that is most beautiful and very popular on all the best places in the country. Nothing can exceed the great beauty of the kalmias and the rhododendron; they add so much beauty and finish to every place where used. In our climate, where the sun shines with great fierceness, they do not suc-

ceed except under conditions of some shelter from the hot sun and drying winds. If possible, naturally protected locations should be selected, but where these are not available artificial protection during the winter must be provided by means of pine boughs, boxes, etc., set up around



FIG. 114.—JAPANESE ROSE (*Rosa rugosa*).

them. Too close covering should be avoided, as with a very close box, barrel, or close straw covering. All that is required is shelter from fierce drying winds and the burning sun during the winter. If a box is used, it should be with openings on the north or west side, to allow a free

circulation of air about them. Some of the best varieties are

Boxwood.	Rhododendron Maxima.
Laurel, Mountain.	" Catawbiense.
Holly, Am.	Andromeda.

BOXWOOD (*Buxus sempervirens*).—This little beautiful evergreen shrub is fast becoming extinct in the northern sections of the Middle and Eastern States, where a quarter of a century ago it was largely used for a low hedge or border or as specimen plants. It succeeds best in a rather moist, somewhat shaded place, but soon fails where planted in thin soil or a southern exposure. Where a low, formal outline is desired for edges of walks or beds, it serves a good purpose, but lacks the graceful natural beauty of the laurel or *Mahonia*.

MOUNTAIN-LAUREL (*Kalmia latifolia*).—One of the most beautiful evergreen shrubs in the world, found growing wild in nearly every State east of the Rockies in hilly or mountainous regions. It succeeds best in partial shade or cool northern slopes and in rather moist soil. It is difficult to transplant, and if taken from the fields or woods only small plants must be used and these must be dug with a considerable bog of earth upon the roots. If planted in a very much exposed situation, protection of pine boughs should be given during the winter.

AMERICAN HOLLY (*Ilex opaca*).—A native shrub with leaves and berries closely resembling the European holly. In exposed places north of Washington, D. C., the leaves turn dark brown during the winter and are often injured by the hot sun. Should be planted in shelter, shaded from the hot sun and protected during the winter with pine boughs.

RHODODENDRON, GREAT LAUREL (*R. maxima*).—A native shrub found growing in shady places along the coast from Maine to Florida. Not very much used, but would serve a good purpose if planted in the shade in rather moist, porous soil.

MOUNTAIN-RHODODENDRON (*R. Catawbiense*), Fig. 115.—The most showy of all of the flowering shrubs when in



FIG. 115.—RHODODENDRON CATAWBIENSE.

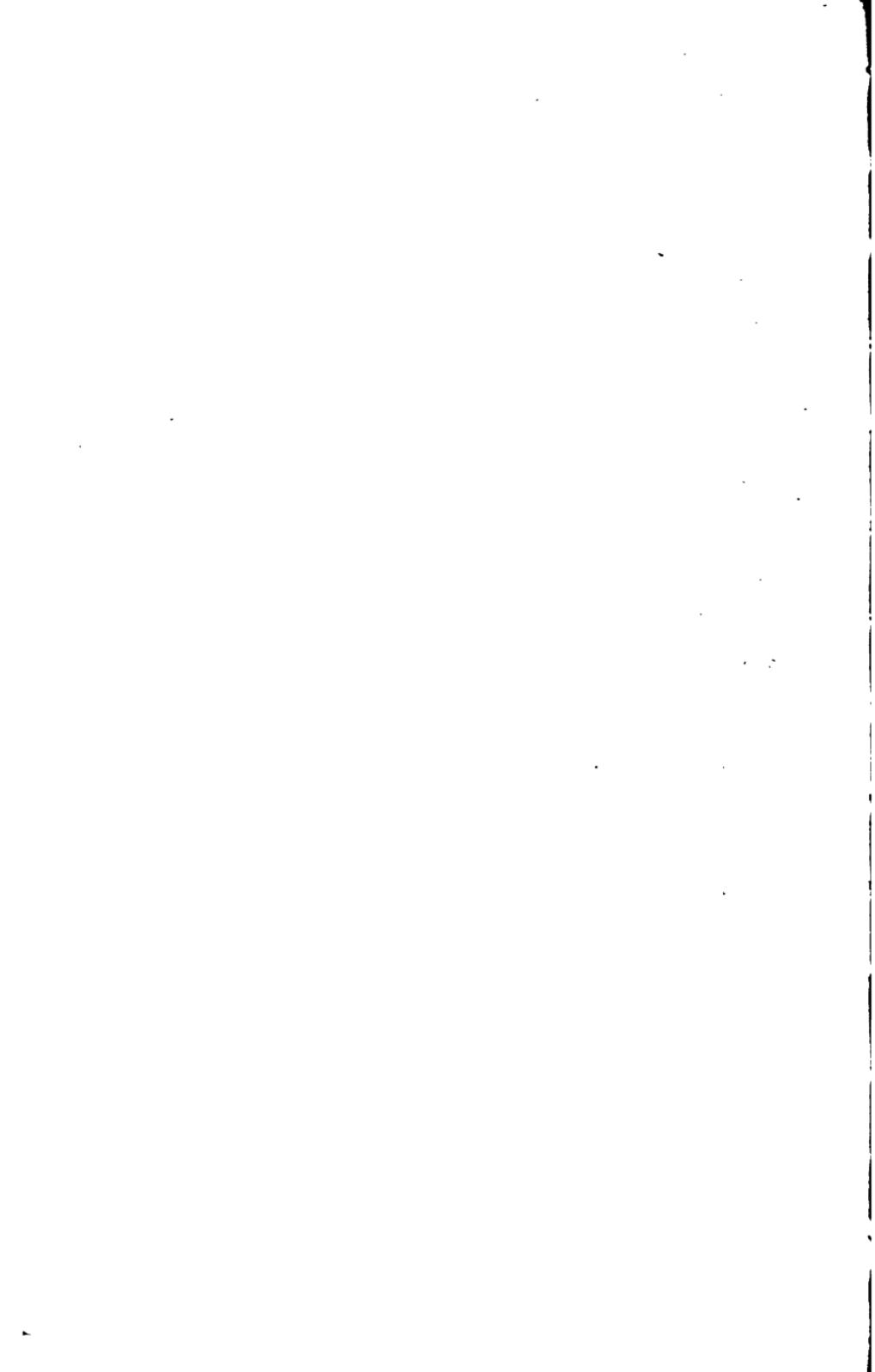
bloom and during the winter on account of its large dark green leaves. It succeeds best in a rather moist, fibrous soil, but does well in almost any kind if it is made porous, not too dry, and if the plants are sheltered from the burning sun during the winter. While young especially, pine boughs or some other protection should be put up around them to keep the leaves from burning and to keep off fierce drying winds.

The number of varieties offered by nurserymen is very large, but a comparatively small number of them are hardy



FIG. 116.—VINE-COVERED COTTAGE IN JUNE.

(To face page 212.)



in northern New England. Some of the best varieties for general planting are *Album elegans*, *Everestianum*, *Superba elegans*, *Roseum elegans*, *Speciosa*, etc.

ANDROMEDA (*Andromeda floribunda*).—A very pretty shrub, producing an abundance of white flowers in the early spring. Requires much the same treatment as the rhododendron.

Climbing Vines.

Without climbing vines many beautiful homes would present a sad and unprotected picture during our hot summers. They grow quickly, cover verandas, porticoes, porches, arbors, walls, fences, etc., with a living green that is far more beautiful than any artificial structure and affording grateful shade during our hot summer days. Fig. 116 shows a vine-covered cottage in June, covered with roses, *Actinidia arguta* and *Ampelopsis Virginiana*, with a group of ferns at the foot of the porch on the right. On the left is a large specimen of *Philadelphus coronarius*, while on the right is one of *Philadelphus grandiflora*. Fig. 117, vine-covered cottage in April. Among the best of this group are the following:

Woodbine, Japanese.	Honeysuckle, Japanese.
“ American.	Wistaria, Chinese.
Clematis or Virgin's-bower.	“ White.
“ White.	Kokwa or Actinidia.
“ Jackman's.	Trumpet Creeper.
“ Jap. Sweet-scented.	

WOODBINE (*Ampelopsis quinquefolia*).—This beautiful native vine is very useful for covering arbors, trellises, verandas, fences, half-dead trees, stumps, etc. It is a

rapid grower, is beautiful in foliage and in fruit, especially in its autumnal tints. It is also free from insect or fungous attacks, but requires some support on smooth surfaces, as it reaches large size, the tendrils not being strong enough to hold up its increasing weight.

JAPANESE WOODBINE (*A. tricuspidata, var. Vietchii*), Fig. 118.—By far the finest vine we have for covering



FIG. 118.—JAPANESE WOODBINE (*Ampelopsis tricuspidata, var. Vietchii*).

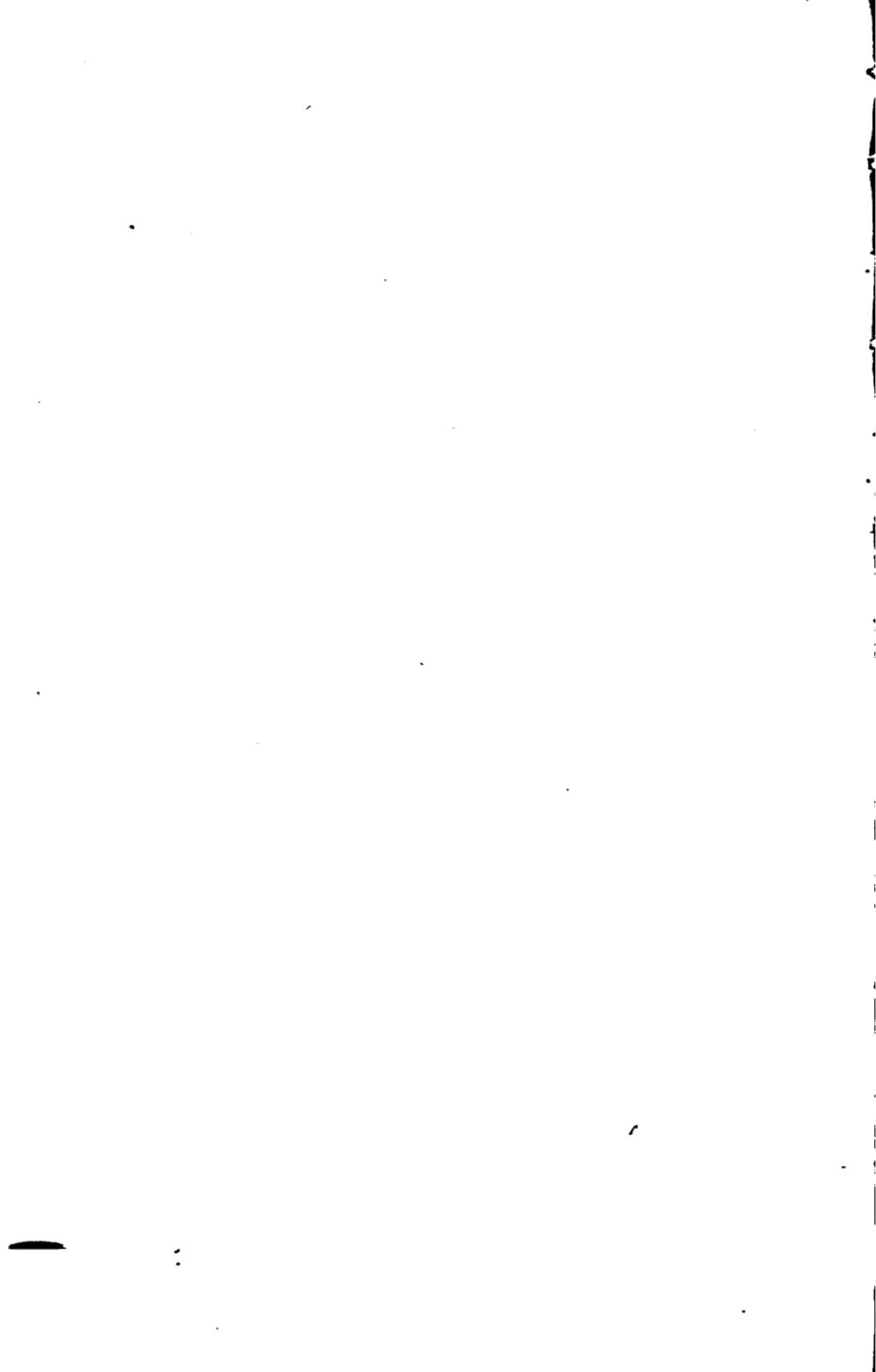
stone and brick buildings, walls, etc. It grows rapidly, clings firmly by its numerous disk-tendrils, and does not run across openings formed by doors and windows. It colors up most beautifully in the autumn and is easily propagated from seeds or cuttings.

VIRGIN'S-BOWER (*Clematis Virginiana*).—A beautiful native climbing shrub, with large clusters of white flowers



FIG. 117.—VINE-COVERED COTTAGE IN APRIL.

(*To fine name 914*)



in July followed in September by the beautiful tasselled fruit. Not much planted in cultivated grounds, but is worthy of cultivation in even the most pretentious places,



FIG. 119.—*CLEMATIS JACKMANII*, *C. HENRYI*, AND *PANICULATA*.

and would be much more largely used were it not so common along the roadsides and fences.

JACKMAN'S CLEMATIS (*C. Jackmanii*), Figs. 119.—A beautiful climbing vine, but, like all of the species of

the clematis, the canes are very weak and easily injured or broken. The flowers are intense violet-purple, large, and much out of proportion to the weak vine. When planted in a sheltered place with wire netting to protect it from being broken, it often grows well for several years, but the average experience with it is that it is destroyed in one way or another after a few years' growth.



FIG. 120.—JAPANESE HONEYSUCKLE (*Lonicera Japonica Halliana*).

WHITE CLEMATIS (*C. Henryii*), Fig. 119.—Flowers of the same size and form as the last, but pure white in color.

JAPANESE OR SWEET-SCENTED CLEMATIS (*C. paniculata*), Fig. 119.—A rapid-growing vine, producing clusters of star-shaped sweet-scented white flowers in wonderful profusion in September. A promising addition to our list of late-flowering climbing plants.

JAPANESE HONEYSUCKLE (*Lonicera Japonica Halliana*), Fig. 120.—This vine has the advantage that it will “grow” under almost any condition. The flowers are yellow, changing to a pure white, and are fragrant and abundant from June to September. It should be trained to wire netting or some other support, for if allowed to lie on the ground every branch will take root and it becomes difficult to eradicate it, except by constant pulling and hoeing up of all suckers not desired. With a slight protection of leaves, straw, or pine boughs, or by the vines lying on the ground, the leaves remain perfectly green all winter, but in full exposure they turn brown during the latter part of winter and are anything but ornamental. This is a valuable shrub for covering dry or steep embankments which are difficult to cover with grass.



FIG. 121.—CHINESE WISTARIA (*Wistaria sinensis*).

CHINESE WISTARIA (*Wistaria sinensis*), Fig. 121.—One of the most rapid growing vines, producing large pendent panicles of light blue flowers in great profusion. It is one of the few vines that will twine around large supports, pillars of verandas, or arbors.

WHITE WISTARIA (*W. s., var. alba*).—Like the last in growth, but producing white flowers.

KOKWA OR ACTINIDIA (*Actinidia arguta*).—More vigorous even than the wistaria and with better foliage, but the flowers are inconspicuous. It will cover an arbor or trellis more quickly than any vine we have. Some of the vines produce a small green fruit that one soon learns to like. Native of Japan.

Another species of Kokwa, *A. polygama*, has been introduced resembling the last-named species, not so vigorous, but the leaves at the ends of the growing shoots change on the upper surface to a glistening white, making it a most strikingly beautiful vine. Cats are especially fond of it, and while young protection of wire netting needs to be put up around to keep them from tearing the vines in pieces.



FIG. 122.—TRUMPET-CREEPER (*Bignonia radicans*).

TRUMPET-CREEPER (*Bignonia radicans*), Fig. 122.—Where hardy, this is a very beautiful and satisfactory climber, though it will not hold itself to the walls of buildings and trellis-supports as well as many others. North of 42° of latitude it must be protected during the winter

with some light, airy covering or be grown slowly in grass borders. The trumpet-shaped flowers of a deep orange-red are borne in large clusters and form very pleasing contrasts with the dark green foliage.

Hedge-plants.*

Hedge-plants are used for two purposes, i.e., to serve as a boundary-line that shall be more natural and ornamental than a stone wall or fence, and as a protection from animal or other trespassers; and if either of these is a necessity a well-kept hedge serves a very good purpose, though there are few, if any, places where the fence, wall or hedge even can add much to naturally beautiful surroundings. Among the best trees and shrubs for this purpose are the following:

Locust, Honey.	Rose, Japanese.
Arbor-vitæ, Siberian.	Privet.
Hemlock-spruce.	Buckthorn.
Boxwood.	Barberry, Common.
Quince, Japanese.	" Purple.

SIBERIAN ARBOR-VITÆ (*Thuja occidentalis, var. Siberica*), Fig. 94, page 184.—Already described under "Evergreen Trees."

HEMLOCK-SPRUCE (*Abies Canadensis*).—Described under "Evergreen Trees." Must be planted in a deep, cool soil with some protection from cold northwest winds.

Boxwood (*Buxus sempervirens*).—Described under "Evergreen Shrubs." Desirable for a small, low hedge or border.

JAPAN QUINCE (*Cydonia Japonica*), Fig. 99, page 192.—One of the most rapid growing and hardy of our shrubs

* For treatment of hedges see page 80.

and especially valuable for hedges. It requires considerable care to keep it in perfect form and should be severely headed in at planting to make it throw up numerous shoots at the base, without which a good hedge cannot be made. It is not a shrub that will bear as close pruning as some others, but if allowed to take a natural bushy form it is very beautiful in flower and has a rich dark green foliage.

HONEY-LOCUST (*Gleditchia triacanthos*).—None of our deciduous trees makes a hedge that is sure to turn animals or the small boy so effectually as this, when properly treated. As with most trees or large-growing shrubs, severe pruning is required to give them the strong growth of numerous branches at the base, and then each succeeding year if it be cut back from six inches to one foot longer than the last it soon forms a dense mass of strong shoots near the ground, covered with numerous branching spines.

JAPAN ROSE (*Rosa multiflora*).—This very strong growing rose promises to become a valuable hedge-plant. On account of its vigor of growth and the numerous spines it will turn animals, fruit-thieves, or other trespassers, and is ornamental in flower and fruit. In habit of growth it is compact, thrives in very poor soil, and as yet has never been injured by cold in the vicinity of Amherst and other sections of Massachusetts.

PRIVET (*Ligustrum vulgare*).—A neat, compact shrub, that stands pruning perhaps quite as well as anything we have. The same treatment as given for the Japan quinces and other hedge-plants is needed as to early formation of lateral branches. Old hedges of this species that have lost their lower branches or that have grown many years at the top only may be renovated by cutting down to within 6 to

10 inches of the ground in the spring before growth begins, when numerous new, strong shoots will come out from the stubs and soon a new and well-formed hedge will result.

BUCKTHORN (*Rhamnus catharticus*).—Somewhat resembling the last in habit of growth, is hardy and tough, and stands shearing well.

COMMON BARBERRY (*Berberis vulgaris*).—This may be used as an ornamental hedge and when grown of large size becomes protective. The more strong branches that can be secured at the start of the hedge the better. Close pruning will not give as good results with this species as the more natural growth of the bush obtained by cutting out here and there a cane to correct the form of each shrub and to cause it to thicken up and branch low.

PURPLE BARBERRY (*B. v., var. purpurea*).—This was fully described under "Ornamental Shrubs." Not quite so vigorous as the last, nor does it make quite so fine a hedge, though the purple foliage and the golden pendent blossoms are very beautiful.

FLOWERING HEDGES.—*Spiræas*, *hydrangias*, *lilacs*, *roses*, and many other flowering shrubs may be used for hedges and often very pleasing results be obtained. To make the best show, they should be planted at sufficient distance to give each plant full development, and they should be encouraged to make numerous branches at the base. The different species of shrubs will require somewhat different treatment as to pruning to produce the largest show of blossoms. (See Pruning Hedges and Shrubs, pages 79 and 83.) They may be made of one kind, as the *hydrangias*, *lilacs*, *spiræas*, etc., or many species may be planted together. The largest should be planted in the middle of the group

or in the rear of the border when the hedge is made of considerable width. The advantage of the mixed grouping is that something may be had in bloom at nearly all seasons of the year, but it will be almost impossible to make as even and true outline as with shrubs of one kind.

CHAPTER XIII.

HARDY HERBACEOUS PLANTS—TENDER BEDDING-PLANTS —TENDER CLIMBERS AND SUBTROPICAL PLANTS.

LONG lists of hardy herbaceous plants are given in the catalogues of many nurserymen, and a large proportion of the species and varieties advertised are valuable under proper conditions of soil, exposure, and care, but the majority will not give satisfaction under ordinary treatment given by the amateur, and in the following list I shall only describe a few of the most desirable and easily grown.

Paeonia, Chinese.	Iris, Japanese.
" Tree.	" German.
" Cut-leaved.	Poppy, Oriental.
Phlox, Garden.	Feverfew, Hardy.
" Dwarf or Moss-pink.	Bloodroot.
Hollyhock.	Wake-robin.
Anemone, Japanese.	Pansy.
Columbine.	Violet, English.
Aster, Native.	Yucca.
Spiraea, Japanese.	Lily, Golden-banded.
Daisy, English.	" Lance-leaved.
Poppy, Plume.	" Garden Easter.
Lily-of-the-valley.	" Long-flowered Easter.
Fraxinella.	" Harris, Easter.
Carnation-pink.	" Turk's-cap.
Plantain-lily.	" Bateman's.
Mist-plant.	Dutch Bulbs.
Sunflower, Hardy.	Gladiolus.
Golden Glow, Rudbeckia.	

CHINESE PÆONIAS (*Paeonia sinensis*).—The finest of all the pæonies in that it is hardy, vigorous in growth, and gives an almost endless variety of color and forms of flowers. For massing it is one of the most showy plants, but the foliage dies down during the last of July and early August, and the beds must be filled with something ornamental after this occurs. They are easily propagated: a single clump after three or four years of growth may be so divided as to make from five to ten plants. After having been grown four or five years in one bed they are much improved by this division, manuring the bed, and replanting only one good clump of two or three eyes where the old clump grew. The fall, September or October, or very early in the spring is the best time for transplanting. Desirable varieties may be obtained from almost any nursery.

TREE-PÆONY (*P. montana*).—The flowers of this species are rather more delicately shaded and beautiful than the last. It produces a woody stem that continues to increase until under favorable conditions it reaches a height of 2 to 4 feet. While generally considered hardy, it will be much benefited if protected by a wrap of rye-straw or pine boughs set up about them.

CUT-LEAVED PÆONY (*P. tenuifolia*), Fig. 123.—This species has finely cut foliage and dark crimson flowers that open considerably in advance of the other species.

GARDEN PHLOX (*Phlox paniculata*), Fig. 124.—One of the most easily grown hardy perennials, and the large number of beautiful varieties now offered makes it especially desirable. The growth and size of the flowers are much improved if the clumps are divided and transplanted, as described for the pæony, once in four or five years. In selecting varieties dull colors should be avoided, as the



FIG. 124.—GARDEN PHLOX (*Phlox paniculata*)
(To face page 224.)



flowers lose their brilliancy after having been open a little while, and it is only the most brilliantly colored ones that are satisfactory.



FIG. 123.—CUT-LEAVED PÆONIA (*Paeonia tenuifolia*).

MOSS-PINK (*P. subulata*), Fig. 125.—This early-blooming little plant produces such a wealth of flowers that it



FIG. 125.—MOSS-PINK (*Phlox subulata*).

should be planted wherever it will succeed. It thrives best in a rather dry location, and very pretty designs may be made by arrangement of the pink- and white-flowered varieties.

HOLLYHOCK (*Althea rosea*), Fig. 126.—Some of the most beautiful results are sometimes obtained by grouping this



FIG. 126.—HOLLYHOCK (*Althea rosea*).

flower with a suitable background, as a sloping lawn, a cluster of evergreens, or other trees or shrubs with a dark green foliage. The plant is a biennial and succeeds best if planted in new soil each time. The seed sown in the open ground in May will produce plants that will bloom the following season, and under favorable conditions bloom a second season, but the best flowers are always produced the second season from seed. The hollyhock rust is sometimes very injurious, and may be kept in check by spraying with the Bordeaux mixture or largely prevented by planting on new soil each season.

JAPANESE ANEMONE (*Anemone Japonica*).—This is a beautiful addition to our list of autumn-blooming her-

baceous plants, as it blooms from September to November, when few other plants are in bloom. The flowers are large and showy and of two colors, red or rose-color and white.

COLUMBINE (*Aquilegia vulgaris*), Fig. 127.—The common garden columbine varies very much in color and form of flowers and is very easily grown. It is best to sow seeds



FIG. 127.—COLUMBINE (*Aquilegia*).

every two or three years to renew the stock. The Rocky-Mountain yellow (*A. chrysantha*) and the blue (*A. caerulea*) succeed well in rather moist locations.

NATIVE ASTERS.—Many species of our native asters are very beautiful, and under proper conditions succeed in cultivation. Under the shade of avenue- or street-trees *Aster cordifolius* and *A. undulatus* grow beautifully in

the Northern States. Other species grow in dry and exposed places, while still others prefer a moist and somewhat sheltered place, and in the selection of species one must take those that naturally grow under conditions of soil intended to decorate. Young plants should be selected if possible, and late fall or early spring is the best time to transplant.

JAPANESE SPIRÆA (*Astilbe Japonica*).—A very beautiful and easily grown plant, well adapted to growth in beds or borders and also much used for forcing. It produces beautiful feathery panicles of pure white flowers in June. The clumps need dividing and replanting once in three or four years. The variety "grandiflora" is superior to the common form.

ENGLISH DAISY (*Bellis Perennis*), Fig. 128.—A beautiful little flower, varying from white through all shades of



FIG. 128.—ENGLISH DAISY (*Bellis perennis*).

pink to the deepest red, easily grown, and rapidly propagated from seed or by division. It requires slight protection of pine boughs to keep it from winter-killing.

PLUME-POPPY (*Bocconia Japonica*).—No herbaceous perennial plant produces more subtropical effect than this one. The leaves are large, deeply lobed, of a glaucous green color, and the flowers are plume-like panicles followed by numerous pods that continue its beauty for a long time. It grows from 5 to 8 feet high and spreads rapidly, but not to such an extent as to be uncontrollable. By pulling out the suckers in the spring that come up beyond the limits



FIG. 129.—LILY OF THE VALLEY (*Convallaria majalis*).

of the space desired that it shall occupy it can be easily kept within bounds, and this thinning will result in a more vigorous growth of the remaining canes. Only a limited

number of the shoots that start in the spring should be allowed to grow. All others should be pulled out or broken off as soon as they appear.

LILY-OF-THE-VALLEY (*Convallaria majalis*), Fig. 129.—This little flowering plant, so much sought for and so beautiful, may be easily grown in shaded places. It spreads rapidly and needs thinning out occasionally to insure an abundant bloom. A light dressing of compost in the fall will improve the size and number of the flowers produced.

FRAXINELLA OR GAS-PLANT (*Dictamnus Fraxinella*).—A very hardy old garden-plant, producing large terminal



FIG. 130.—CARNATION-PINK (*Dianthus caryophyllus*).

racemes of flowers. There are two forms: the pink- and the white-flowered. It is called the gas-plant because of an explosion that occurs when a lighted match or lamp is

held close up to the open flowers. This was supposed to be an explosion of gas, but close investigation has shown that it is the result of the combustion of an easily ignited wax secreted on the petals.

CARNATION-PINKS (*Dianthus caryophyllus*), Fig. 130.—Some of the varieties of the carnation-pink are hardy, very beautiful, and easily grown from seed and also by slips. To have them go through the winter uninjured they should be given a slight protection of straw or pine boughs.

PLANTAIN-LILY (*Funkia subcordata*), Fig. 131.—A most beautiful old garden-plant with large cordate leaves



FIG. 131.—PLANTAIN-LILY (*Funkia subcordata*).

of a light green color, producing clusters of pure white flowers. Very ornamental in the garden and succeeds well in tubs or boxes on the lawn or veranda.

MIST-PLANT (*Gypsophylla paniculata*).—A tall plant with small glaucous leaves and a very large open panicle of minute white flowers that are very pretty for lightening up bouquets and arranging with all kinds of flowers. It is perfectly hardy and requires but little care to keep it growing to perfection.

HARDY SUNFLOWER (*Helianthus multiflorus*), Fig. 132.—One of the most striking of the hardy perennial plants.



FIG. 132.—HARDY SUNFLOWER (*Helianthus multiflorus*).

The flowers are large, perfectly double, of a golden-yellow color, and produced in great profusion. Its blossoms are rather coarse and do not last long, but their brightness and perfect form make them valuable additions to large places. A slight protection of coarse manure over the roots is sometimes needed.

GOLDEN-GLOW (*Rudbeckia laciniata*).—Similar to the last, but with a more brilliant and not quite so double yellow flower, very hardy, easily grown, and will be very popular for a time.

JAPANESE IRIS (*Iris Kæmpheri*), Fig. 133.—Next to the chrysanthemum, this species of iris is the most popular flower in Japan, and it well deserves the esteem with which it is held by this most progressive Eastern nation. The flowers are very large, often six inches across, of varying

colors and markings, ranging from pure white through all the shades of pink, dark red, and purple to almost black, with many peculiar combinations and mixtures of colors.



FIG. 183.—JAPANESE IRIS (*Iris Kœmpheri*).

It succeeds best in a rather moist, rich soil. Many other species of iris are very beautiful and desirable, among the best of which is the

GERMAN IRIS (*Iris Germanica*).—The foliage of this species is more glaucous than that of the Japanese, and the flowers possess many shades of yellow and orange in addition to the varying colors of the latter, though the colors are not so brilliant or well defined. It grows upon light soil quite as readily as upon a heavy one.

ORIENTAL POPPY (*Papava orientalis*), Fig. 134.—The flowers of this species are of the most brilliant scarlet color,

marked with an almost black centre. It is perfectly hardy, and all the care required to grow it successfully after planting is to apply a dressing of fine compost on the bed in the



FIG. 134.—ORIENTAL POPPY (*Papaver orientalis*).

fall and keep the grass and weeds from choking out the plants during the summer.

HARDY FEVERFEW (*Pyrethrum roseum* and *cinerariifolium*).—Many beautiful double-flowering varieties of the above species have been introduced and are so easily grown and beautiful both in foliage and flower that they should be more generally planted. The blossoms of these species are used for the manufacture of the powder known under the names of Persian, Dalmatian, and Buhack insect-powder.

BLOODROOT (*Sanguinaria Canadensis*).—A very common and most beautiful native plant, producing its pure white flowers very early in the spring. It grows best in moist, shaded places among rocks and underbrush, and is easily transplanted from its wild state to the garden. The very early blossoms are followed by broad, lobed glaucous leaves that retain their beauty for a considerable part of the summer.

WAKE-ROBIN (*Trillium erectum, erythrocarpum, and grandiflorum*).—All very pretty early-blooming species, requiring moist, shaded locations to give the best results, and are easily transplanted from the woods to the garden.

PANSY (*Viola tricolor*), Fig. 135.—When properly grown no early-blooming flower gives more satisfaction.—So much show outside and so many flowers for indoor decoration.—To obtain the best results the seed should be sown in August in a cool, airy place, and when three or



FIG. 135.—PANSY (*Viola tricolor*).

four of the middle leaves have formed be transplanted to a bed where they may be protected for a time from very severe freezing until they have reached a size to show some flower-buds. They then should be exposed to the weather to harden them off and be protected from severe freezing during the winter by a covering of pine boughs and a few leaves. Too deep covering will destroy the plants by producing fermentation. In the spring the covering should be removed as soon as severe freezing is over, in this section about April 1st, fine rich manure be worked in about the plants, and the soil settled by a heavy watering. All of the very early buds should be removed as soon as open

until the plants have gained good size and are vigorous, when the blossoms may be allowed to mature and they will then be of large size. These plants may be transplanted to beds on the lawn or in the garden and produce large quantities of blossoms for two months, i.e., April to June. All faded flowers should be removed and none of the seed-pods be allowed to mature if the largest flowers are desired, as the development of a single seed-vessel will exhaust the plants more than the production of a dozen flowers.

ENGLISH VIOLET (*V. odorata*), Fig. 136.—This little plant can also be successfully grown in the garden or lawn



FIG. 136.—ENGLISH VIOLET (*V. odorata*).

with a little care. The best method for the amateur with no greenhouse facilities is to divide the old crowns after they have bloomed in the spring and plant in a moist, slightly shaded place, keeping the ground well cultivated, and during the summer pick off all runners, thus forcing the plants to make a large number of crowns and many flower-buds. If the plants are not where they can be protected during the winter, they may be transplanted in October to a more sheltered place and be given a little shelter with coarse manure, leaves, or pine boughs when severe freezing

weather sets in the last of November or early December. In the spring they should be uncovered as soon as the snow disappears and some fine, well-rotted manure be worked in about them, when, with an abundance of rain to settle the soil about the roots, the flowers will grow rapidly and be of large size.

YUCCA OR ADAM'S NEEDLE-AND-THREAD PLANT (*Yucca filamentosa*), Fig. 137.—A very beautiful and hardy plant, producing striking effects on the lawn, with its long upright narrow leaves and large panicle of creamy-white



FIG. 137.—YUCCA (*Yucca filamentosa*).

flowers rising 4 or 5 feet high. It is especially appropriate with evergreens in the background and among rocks. It is easily propagated by division or from seed, and grows many years without renewal.

LILIES.—No place is complete without some of the species of this queen of flowers. Some of them are very easily grown and give great satisfaction. For the best results they should be planted in a deep, mellow soil, one not affected by drouth and yet not wet. The bulbs should be planted from 4 to 6 inches deep as early in the fall as

they can be procured, which is often not until October, most of the bulbs being imported. Bulbs already in the garden should be transplanted in August or as soon as the flower-stalks die down. It will be found a great advantage to take up and separate the bulbs of the lily-bed, renew the



FIG. 138.—GOLDEN-BANDED LILY (*Lilium auratum*).

soil, and replant once in three or four years. Among the best varieties are:

GOLDEN-BANDED LILY (*Lilium auratum*), Fig. 138.—This is the finest of all the Japan lilies. The flowers are large, white, spotted with dark crimson, and with a golden line or band along the centre of each petal. The flowers often grow in large clusters, as many as forty sometimes

appear on a single stalk, but the ordinary number is about six to ten. There are several varietal forms of this superb lily.

LANCE-LEAVED LILY (*L. lancifolium* or *speciosum*).—Rather more hardy and easily grown than the last, and producing beautiful flowers of somewhat the same character and markings, but without the golden band. The two varieties *album* and *rubrum*, white and pink, are distinct and desirable.

GARDEN EASTER LILY (*L. candidum*).—This pure white lily has long been in cultivation, and when not attacked by the "lily-blight," a disease peculiar to this species, is perhaps the best white lily for garden cultivation.

LONG-FLOWERED JAPAN LILY (*L. longiflorum*).—A vigorous and hardy species producing very large tubular white flowers. The variety known as the Bermuda Easter lily (*L. Harrisii*) is largely used for forcing for Easter decorations.

TURK'S-CAP LILY (*L. superbum*).—One of the finest of all the lilies in size and vigor of growth of plant, often reaching 6 feet in height. It succeeds best in rather moist soil, and the flowers vary from orange to red, spotted, with recurved petals and producing a large number on a stalk.

BATEMAN'S LILY (*L. Batemanii*).—Plants of medium growth with erect orange or apricot-colored flowers. Thrives well in a variety of soils, but succeeds best in one of a rather light, deep nature.

DUTCH BULBS.—Varieties of hyacinths (*Hyacinthus orientalis*), tulips (*Tulipa Gesneriana*), crocus (*Crocus sp.*), narcissus, daffodils, and jonquils (*Narcissus sp.*), Fig. 139. Few plants give more beauty for the labor and expense involved than beds of these early-blooming plants. Most of

these bulbs are grown in Holland, whence the name. They are especially desirable on the lawn or in borders along the walks and near the house. For the best success the bed should be made deep and rich in August or September, and the bulbs be planted from 4 to 6 inches deep as soon as they can be obtained in the fall. A heavy covering of coarse manure on the bed just before the ground freezes will keep out the frost and hasten the time of blooming in the spring. This covering should be removed as soon as the snow dis-



FIG. 139.—DUTCH BULBS.

appears in the spring, otherwise the tops may start so as to be much injured when uncovered.

Beds of hyacinths, tulips, or crocus planted by themselves are often more satisfactory than in mixed beds, unless the quantity of each is small, when the mixed bed may be better.

GLADIOLUS are tender bulbs, used for summer decoration, and require but little care and give a large amount of showy blossoms.

Tender Bedding-plants.

The number of tender bedding-plants that may be used for the decoration of home grounds is very great, but the limits of this work will allow of the description of only a few of the most important. Some of them are obtained by starting from seed, some by division of root, and many



FIG. 140.—*SWEET PEA (Lathyrus odoratus)*.

of them by cuttings rooted under glass. Among those started from seeds are:

SWEET PEA (Lathyrus odoratus), Fig. 140.—This plant is becoming so popular, and deservedly so, that special directions for its growth are given. It is easily grown and the seed is so cheap that there is no excuse for any one being without this delightful flower. For the best results

a rich, cool soil is required and the seed should be planted as early in the spring as the ground will work up fine and mellow. Sow the seed 3 to 4 inches deep, or perhaps better plant them in a trench 4 inches deep, but covering only 2 inches deep at planting, and fill up to the level in the process of cultivating. Various kinds of supports are used, but the neatest and the cheapest support in the end is common poultry-netting 3 feet wide stretched firmly on strong posts. Constant picking of the flowers will tend to increase the time of blooming, for if no seed is matured the strength of the plants will go to the production of flowers. Nothing exhausts the vitality of plants so much as the production of seed.

Of the many other varieties of plants that are grown from seed space will not permit of description; but we give a list of some of the best:

Alyssum, Amaranthus tricolor, Snapdragon, Asters, Balsams, Calendula, Calliopsis, Candytuft, Centaurea (Dusty-miller), Coxcomb, Cosmos, Dahlia, Datura, Escholtzia, Golden Feverfew, Marigold, Mignonette, Petunias, Poppies, Portulacca, Nasturtium, Verbena, etc.

Some of the best of the bedding plants that are grown from cuttings are:

Alternanthera, Alyssum, Coleus, Geraniums, Heliotrope, Salvias, etc.

Tender Climbing Plants.

Some of the best tender climbers are:

Canary-bird Flower, Cobea, Cypress-vine, German Ivy, English Ivy, Morning-glory, Star-cucumber, Nasturtium, etc.

Subtropical Plants.

Canna.	Banana, Abyssinian.
Castor-bean.	Blue-gum Tree.
Caladium.	Cacti.
Papyrus, Egyptian.	Hydrangia (tender).

Strongly marked features in lawn or in garden may be produced by the use of subtropical plants, i.e., those with large leaves or large growth of stem and flowers. They may be so grouped together as to render otherwise tame landscape views attractive. Most of these plants being



FIG. 141.—CANNA (*Canna Indica*).

tender and requiring a rich and moist, warm soil, cannot be put out until the ground has become well warmed and are better to be started under glass and grown to considerable size if immediate effect is desired. Among those that can be most easily grown and give the best results are the following:

CANNAS (*Canna Indica*), Fig. 141.—These rapid-growing plants vary from 1 to 6 feet in height, and in foliage from the brightest green to a very dark purple, and with a

great variety of blossoms, especially the new strains of the French and hybrid cannas, which are exceedingly showy and beautiful. The tubers are easily preserved in any warm, dry cellar, and are rapidly propagated by division in March or April. For those who have no greenhouses the window-box or a shallow box of soil placed behind the kitchen stove or in a light, warm cellar will serve a very good place in which to propagate them. The tubers should be cut



FIG. 142.—CASTOR-BEAN (*Ricinus communis*).

into single eyes or buds, covered with 2 or 3 inches of rich, sandy soil, and the temperature kept at about 65°, when they will quickly start into growth and be ready for transplanting to the open ground about June 1st. In grouping cannas the best results are obtained by placing varieties side by side, with as great a contrast of foliage or color of flowers as possible; the larger ones in the centre of the bed

or group and the smaller ones on the outside. Most of the leading florists and seed- and plant-dealers now offer an abundance of beautiful varieties at low prices, and when a small stock is once obtained by a little skill in keeping them through the winter it may be increased very rapidly.

CASTOR-BEAN (*Ricinus communis*), Fig. 142.—This plant is especially ornamental on account of its broad lobed leaves, large showy panicle of flowers, and fruit-pods. The seed should be started under glass in April, and be grown to a foot or more in height before planting out to obtain



FIG. 143.—CALADIUM (*Caladium esculentum*).

results early in the season. They should not be put out into the open ground, however, until about June 1st. As a single specimen in the centre of a large bed or as the background for other small foliage-plants they are very effective.

CALADIUMS (*Caladium esculentum*), Fig. 143.—The leaves of this plant are broad and heart-shaped, often 2 feet across, and hanging obliquely on the leaf-stalk make very beautiful borders for beds of cannas or castor-bean plants,

or they make pleasing single specimens on the lawn. It is also especially useful among rockwork and on the border of water. It requires the same treatment as the canna, though perhaps more heat in starting them into growth than the latter.

EGYPTIAN PAPER-REED OR PAPYRUS (*Papyrus antiquorum*), Fig. 144.—This beautiful plant is being much less used than it should be. It is one of the most beautiful and easily grown plants, either on the lawn, in ordinary



FIG. 144.—EGYPTIAN PAPYRUS (*Papyrus antiquorum*).

garden soil, or on the borders of ponds or basins of fountains. Plants in 6- or 8-inch pots planted in early June will make clumps that would fill a 15-inch pot and be 8 feet high by September. It is best wintered over in a warm greenhouse and should have an abundance of water. Probably it could be carried over in a warm cellar, but I know of no instance of its having been done.

ABYSSINIAN BANANA (*Musa ensete*), Fig. 145.—In a warm, sheltered location, where the wind will not whip and lash the leaves, this is one of the grandest of the subtropical

plants. For the best results the seed should be started under glass at least one year before they are wanted for outdoor work, at which time they should be 4 feet high and in 10-inch pots. In a warm, rich soil such plants will grow to 10 feet in height in a single season and nothing gives a more tropical effect on the lawn or in the garden. Plants may be wintered over in a warm, dry cellar or in a



FIG. 145.—ABYSSINIAN BANANA (*Musa ensete*).

cool greenhouse and be made to serve two or three summers' decoration.

THE BLUE-GUM TREE (*Eucalyptus globulus*). — The beautiful blue or glaucous color of the foliage of this tree together with its rapid growth makes it very useful upon the lawn. It is even more glaucous than the best of the Colorado blue spruces, and in contrast with the dark foliage of evergreens, purple beeches, plums, etc., the effect is very beautiful. The plants must be started about a year before

wanted and be kept growing, when they will reach from 4 to 6 feet in height. Such plants out of doors and in rich soil will grow to 10 or 12 feet in one season. They can be carried over for a second year's decoration by moving to a cool greenhouse before severe frosts.

CACTI.—Many species of these unique and picturesque plants may be used for outdoor decoration during the summer, and especially in connection with ledges and rock-work, where they are very appropriate. None of the large species are hardy and must be wintered in a cool greenhouse or very dry cellar. The plants when thus set out make a clean, healthy growth during the summer, and need to be kept very dry during the winter. It is generally better to plunge the pots rather deep in the ground than to turn them out, especially if the soil is inclined to be dry.

TENDER HYDRANGIAS (*Hydrangia hortensis*).—This species is largely used for veranda and lawn decoration. Its immense, rounded panicles of flowers, white when they first open, change to shades of pink and violet-purple under varying conditions of soil and exposure. They may be kept over winter in a warm, dry cellar, giving them just water enough to keep the branches from becoming wilted. The time for bringing them from the cellar and starting into growth may vary according to the time they are desired in bloom. For early blooming the last of March, and for July and August blooming they need not be started into growth until May.

CHAPTER XIV.

AQUATIC PLANTS, HARDY FERNS, AND ORNAMENTAL GRASSES.

Aquatic Plants.

WHEREVER bodies of water occur, whether large or small, natural lakes, streams, artificial ponds, or fountain-basins, their decoration with more or less of the water-loving plants—*aquatics*—can be made to greatly increase the naturally beautiful effects of such features of landscape, Fig. 146. Much interest has been awakened in the past few years in these plants, and many growers of, and dealers in, aquatic plants are found in different sections of the country. There has been a great increase in the growth of these plants for ornamentation, especially in parks and public grounds as well as on many private places. Many of the “*aquatics*” are easily grown in any shallow body of water that is not fed by cold springs or mountain streams, but some of them, like the *Victoria regia*, require more or less artificial heat, that may be carried to the water by steam or hot-water pipes from some greenhouse or other heating-plant. Many of them are started from seed, while some of them are propagated by division of the roots. Full direction for germinating the seed and growing the plants may be obtained from the catalogues of dealers in this class of plants.

SOIL.—The soil best suited to the growth of most of the aquatics, especially the water-lilies, is one made of equal parts of good garden soil and well-decomposed stable manure. If the plants are grown from seed, they need to be transplanted two or three times until large enough to put into the open air, when they should be planted in a box or tub or be sunken in the mud, pressing the soil firmly about the roots, and then covering the surface of the soil with coarse sand or gravel. It matters little what the depth of water over the plants is after well established; it may be 3 inches or 3 or more feet; but for the water-lilies, it should never get so low as to have the leaves rest on the soil for any considerable length of time. After good growth has begun, if the soil is in the proper condition, but little care need be given except to see that the water does not all evaporate, or that muskrats do not get at and destroy the roots, of which they are very fond. Every means possible, by poisoning, trapping, shooting, etc., should be taken to get rid of the above pests, as a single pair of these animals will destroy a large number of plants in a short time. Among the plants that grow directly in the water are the following:

Lotus, Egyptian.		Water-lilies, Royal Purple.
" White Japanese.	"	Superb.
" Striped Japanese.	"	Devonian.
" Native.	"	East Indian.
Water-lilies, <i>Hardy</i> .		White African.
" " Rose-flowered.	"	Royal or Victoria.
" " Large-flowered.		Water-hyacinth.
" " Yellow-flowered.		Water-poppy.
" " European.		Salvinia.
" " <i>Day-blooming</i> .		Papyrus, Egyptian.
" " Purple African.		Flag, Variegated.

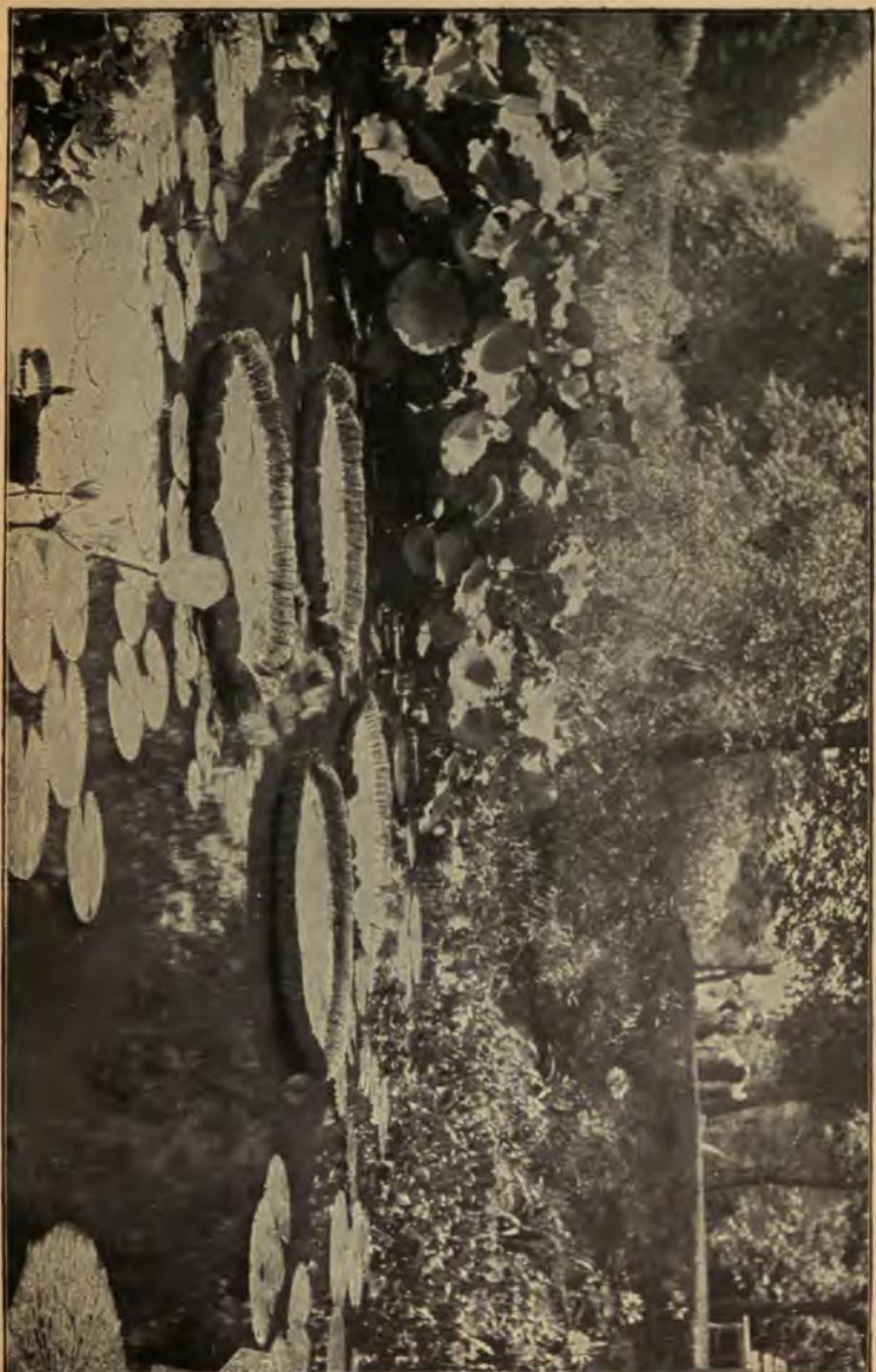
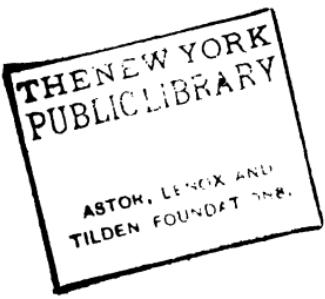


FIG. 146.—AN AROMATIC GARDEN



Porcupine-plant.	Arrowhead.
Parrot's-feather.	Scouring-rush.
Wild Rice.	Pickerel-weed.
Cat-o'-nine-tail.	Bulrush.
Burweed.	Bur-marigold.
Water-plantain.	

EAST INDIAN LOTUS (*Nelumbium roseum*), Fig. 147.—A most beautiful plant, with large peltate or round-shield-



FIG. 147.—EAST INDIA LOTUS (*Nelumbium roseum*).

shaped leaves and large pink or rose-colored flowers. It is easily grown in shallow, warm-water ponds, or in tubs, where it blooms freely. Use a rich, heavy, but not clayey loam.

The other species of nelumbiums that succeed almost equally well with the above and require the same treatment are the WHITE JAPANESE (*N. album grandiflorum*), STRIPED JAPANESE (*N. album striatum*), and the EGYPTIAN LOTUS (*N. speciosum*). The latter resembles the first species, but the flowers are paler in color and not so large and full. The native YELLOW LOTUS (*N. luteum*) is found growing in the ponds and streams of the South and Southwest, and succeeds in warm, sheltered places much further north. All of the above species are claimed to be perfectly hardy in the Northern and Western States if covered with water deep enough so that the ground around their roots will not freeze, i.e., 2 to 3 feet deep, according to latitude.

HARDY WATER-LILIES.—Our native water-lilies, found in many sections of the country, are very beautiful and easily grown, the principal requirements being a deep, muddy soil. Only water enough to cover the roots is all that is absolutely necessary, but they generally grow to greater perfection in 2 or 3 feet of water. In deep water they are easily planted by tying the roots to stones and dropping them in where wanted.

Many beautiful varieties are now propagated and offered for sale, among the best of which are the ROSE-FLOWERED WATER-LILY (*Nymphaea odorata, var. rosea*), Fig. 148, LARGE-FLOWERED WATER-LILY (*N. o., var. superba*), YELLOW WATER-LILY (*N. o. sulphurea*).

The EUROPEAN WHITE WATER-LILY (*N. alba candidissima*) produces rather larger flowers than our native species, is equally hardy, and a more abundant bloomer.

TENDER WATER-LILIES.—The flowers of this group of water-lilies give a greater variety of forms and colors than

those last described. They bloom more freely, showing flowers from July to September, if planted in shallow warm-water ponds or basins. They can also be grown in tubs with good success, but the roots must be wintered



FIG. 148.—ROSE-FLOWERED WATER-LILY (*Nymphaea odorata rosea*).

in a greenhouse-tank or be purchased at the beginning of every season. If considerable skill is exercised by covering the plants with barrels, then with leaves and straw, they may be carried over winter in the tank or pond.

They may be divided into two groups: i.e., first, those blooming during the day, opening in the morning and closing at night; and second, those opening in the evening, remaining open during the night and until toward noon the following day.

The best of the DAY-BLOOMING varieties are: PURPLE ZANZIBAR OR AFRICAN LILY (*Nymphaea Zanzibarensis*), Fig. 149, ROYAL PURPLE AFRICAN LILY (*N. Z. azurea*), SUPERB AFRICAN LILY (*N. Z. superba*). These species may be had in bloom constantly from July to September, if planted in rich soil in shallow, warm water in ponds, basins, or tubs. For the best results in tubs they should

be placed on the south, southeast, or southwest shelter of buildings or shrubbery, where the sun will strike them for 6 to 8 hours per day. A bright, sunny exposure is also



FIG. 149.—PURPLE AFRICAN WATER-LILY (*Nymphaea Zanzibarensis*).

desirable for the location of the pond or tank, that the water may be kept as warm as possible.

The best varieties of the NIGHT-BLOOMERS are: The DEVONIAN WATER-LILY (*Nymphaea Devoniensis*), one of the choicest and most beautiful, with bright rose-colored flowers and scarlet stamens. EAST INDIAN WATER-LILY (*N. rubra*). WHITE AFRICAN WATER-LILY (*N. dentata*), one of the most free bloomers, with flowers of large size and very easily grown. ROYAL WATER-LILY (*Victoria regia*), the largest of all the water-lilies, its leaves often measuring

4 to 6 feet across and the flowers a foot in diameter. Very few persons succeed in blooming this royal flower, and then it is done only where artificial heat is introduced from some greenhouse or other steam or hot-water plant near by. But where such facilities are available the results generally well repay the effort, for nothing of an aquatic growth can exceed the grandeur of the immense floating leaves and large gorgeously colored flowers of this plant.

Many other water-loving plants besides the water-lilies may be used with good effect in aquatic gardens. These may be divided into those growing directly in deep water and those growing in the moist soil on its borders. Of the first are the

WATER-HYACINTH (*Eichhornia crassipes*).—The flowers of this plant resemble those of the common light blue



FIG. 150.—WATER-POPPY (*Lymnocharis Humboldtii*).

hyacinth, and by some it is likened to a species of orchid-blossoms. It grows freely in shallow warm water, each plant, after separating from its parent, floating, driven about

by the winds or currents from one side of the pond or basin to the other. It blooms freely and the very abundant floating roots and inflated petioles or leaf-stalks are very interesting.

WATER-POPPY (*Limnocharis Humboldtii*), Fig. 150.—The bright lemon-colored flowers of this little plant add very greatly to the beauty of any collection of aquatics. Plants set out in June grow rapidly and bloom freely.

SALVINIA (*S. Brasiliensis*).—A very pretty little floating plant with light green almost heart-shaped leaves covered with many soft hairs. It grows freely, and floating about among the larger plants has a very pleasing effect.

AQUATIC BORDER-PLANTS.

PAPYRUS OR REED PAPER-PLANTS (*Papyrus antiquorum*), Fig. 144, page 246.—This plant has already been described under "Subtropical Plants," but is equally useful and beautiful for the borders of ponds and fountain-basins. It is one of the most beautiful of plants, wherever grown, its graceful umbrella-like clusters of leaves being entirely unlike any foliage of the temperate zone. It grows equally well on the banks or in the water at the border, and makes a beautiful centre plant for a group of other upland aquatics or in large clusters by itself.

VARIEGATED FLAG (*Acorus Japonicus variegatus*).—Our native "sweet flag" is familiar to most persons, and this plant is very much like it except that it has most beautifully variegated green and white leaves. It is perfectly hardy and grows freely.

PORCUPINE-PLANT (*Scirpus Tabernæmontani zebrina*).—A beautiful hardy plant with round leafless stems, beauti-

fully marked in sections of white and green, giving it something of the appearance of the quills of the porcupine. This plant and the variegated flag can be so grouped with the light and dark green, the broad- and the narrow-leaved, aquatics as to produce most beautiful effects.

PARROT'S-FEATHER (*Myriophyllum proserpinacoides*), Fig. 151.—This beautiful plant will serve so many purposes for water decoration, makes so rapid growth, and is



FIG. 151.—PARROT'S-FEATHER (*Myriophyllum proserpinacoides*).

so easily grown that it should be much more cultivated than it now is. It makes a most beautiful border-plant for ponds and fountain-basins, and planted in the pans of large fountains its drooping growth in with the falling water produces most charming effects. It may be successfully grown in hanging baskets or basins and over the stones in aquaria. It is so easily propagated that even small shoots, taken off and placed in rather warm water, root in a very few days.

WILD RICE (*Zizania aquatica*).—A rapid-growing grass of large size and graceful form. It is easily grown, in fact

in some places it spreads so rapidly from self-sown seed as to become a nuisance unless heroically weeded out in the early summer.

Many native plants are useful for decorating borders of ponds and streams, among the best of which are the following: CAT-O'-NINE-TAIL (*Typha latifolia*), BURWEED (*Sparganium simplex*), WATER-PLANTAIN (*Alisma plantago*), ARROWHEAD (*Sagittaria variabilis*), SCOURING-RUSH (*Equisetums sp.*), BULRUSH (*Scirpus sp.*), PICKEREL-WEED (*Pontederia cordata*), BUR-MARIGOLD (*Bidens sp.*), and many species of sedges (*Carex*), all of which are found in or about our ponds and streams and may be easily transplanted to more cultivated locations. Some of them, like the *Bidens* and *Typha*, etc., seed very freely, and a little heroic thinning will be needed to prevent them from overrunning the space needed for more desirable plants.

Hardy Ferns.

There are many hardy species of large-growing ferns that are beautiful and easily grown and especially suited for the decoration of shaded places. They thrive best in a rather moist soil, but if in the shade many of them will grow luxuriantly in even thin soil. They are easily transplanted and may be moved from the woods or roadside at almost any time if a large clump of roots and soil is taken up, but perhaps the best time is when they are beginning to grow in the spring and early summer.

Among the best are: MAIDENHAIR FERN (*Adiantum pedatum*), CINNAMON FERNS (*Osmunda regalis*, *cinnamomia*, and *Claytoniana*), CHRISTMAS FERNS (*Aspidium marginale*), SWORD-FERN (*A. acrostichoides*), OSTRICH

FERN (*Onoclea struthiopteris*), RATTLESNAKE FERN (*Botrychium Virginicum*), BLADDER-FERN (*Cistopteris bulbifera*), and *Polypodium vulgare*, *Woodsia ilvensis* and *obtusa* are especially useful for rocks and dry wooded places.

Ornamental Grasses.

A number of hardy and very ornamental grasses may play an important part in home lawn decorations, either in masses by themselves or planted with groups of other decorative plants, trees, or shrubs. They are easily grown



FIG. 152.—PAMPAS-GRASS (*Gynandromorphum argentum*).

and propagated by division of the clump; one clump of two or three years' growth may often be divided so as to make a score or more plants. The great advantage of these

grasses is that they are perfectly hardy and require so little care. Among the best are the following:

PAMPAS-GRASS (*Gynerium argenteum*), Fig. 152, JAPAN PLUME-GRASSES (*Eulalia Japonica*, *E. J. zebrina* (Fig. 153), *E. J. variegata*, *E. J. gracilis*), REED-GRASS (*Arundo donax*), both plain and variegated, etc., RIBBON-GRASS (*Phalaris arundinacea*). The last species spreads



FIG. 153.—JAPANESE PLUME-GRASS (*Eulalia zebrina*).

rapidly and should be kept within bounds by spading up and pulling out all the suckers or stolons as soon as they get beyond the limits of the bed or space it is desired that it shall occupy.

CHAPTER XV.

INSECTS AND FUNGI ATTACKING ORNAMENTAL TREES, SHRUBS, ETC.

ONE of the greatest difficulties one has to contend with in the care of ornamental trees, shrubs, etc., is the injury caused by insects and fungous pests, and in this chapter a brief outline of the most destructive pests will be given, with the best and most easily applied remedies.

The injury done to ornamentals by the above pests is very great, though not so large as that to fruit and garden crops. It is the history of all cultivated plants that the more largely any one kind is grown the more rapidly will its natural enemies, i.e., insects and parasitic fungi, increase, and the more ornamental homes we have the more need there will be to resort to protective or remedial measures to secure satisfactory growth.

No attempt will be made at a strictly technical description of species, but the author will endeavor to give a brief, plain description such as will enable the practical gardener or home-owner to detect the pests that may be injuring his pets and to apply remedies that shall save them from destruction.

In making up this list the author is indebted to the many carefully recorded results given in the bulletins of the experiment-stations published by several States, which

together with a large practical experience in the care of nearly all species and varieties of ornamental trees, shrubs, etc., he hopes will enable him to present the latest and best methods of preventing serious loss from the above pests. The reader is referred to the popular bulletins published by the various experiment-stations often giving illustrations of destructive insect or fungous pests with full treatment for their destruction. If one finds a pest at work and is not familiar with it, samples should be sent at once to the entomologist or botanist of the station for identification and advice as to remedies.

Insecticides.

(Insect-destroyers.)

Practically there are but very few of the common insecticides needed or of much value in the preservation of farm, garden, or ornamental crops, and these are Paris green, hellebore, kerosene emulsion, whale-oil soap, and pyrethrum-powder. The first and second are used for the destruction of chewing insects and the third and fourth for sucking insects.

PARIS GREEN.—This is a chemical combination of arsenic or arsenious acid and copper, technically called arsenite of copper, which is used largely for making paint; the arsenic or arsenious acid being the element that kills insect life. It is a deadly poison and should be used with extreme caution and never be applied in large quantities to crops used as food or be kept in such places as to be accessible to irresponsible persons or children.

Pure Paris green contains but a small per cent of soluble arsenious acid and can be used upon most plants without

injury in sufficient quantities to destroy any insects that feed by biting or chewing the parts. Samples containing more than four per cent of soluble arsenious acid should be used with considerable caution.

DRY PARIS GREEN.—In the powdered form it is applied with a sieve, a fine cloth bag on a pole or stick, with the common sulphur bellows or some of the numerous machines or "guns" that will distribute it upon the surface of the foliage *in very minute quantities*. The principal difficulty, however, found in applying it in this manner is in distributing it in sufficiently minute quantities not to injure the foliage and in making it adhere to the foliage. To overcome these difficulties it is extended or diluted in some way, as with air-slaked lime, plaster, cheap flour, glucose, etc. The best results are obtained by making the application when the foliage is wet with rain or dew.

PARIS GREEN AND PLASTER, LIME, OR FLOUR.—In order to distribute Paris green more thoroughly and economically in a dry form it is often mixed at the rate of 1 lb. to 10 up to 50 lbs. of plaster or air-slaked lime or with from 10 to 20 lbs. of fine dry cheap flour. All of these substances possess some merit, but the two first are nearly as readily washed off by rains as the Paris green itself, while the latter when once moistened forms a paste that upon drying will remain on the foliage for a long time.

PARIS GREEN IN WATER.—By far the best method of applying this poison is mixed with water and applied with a nozzle that will make a very fine spray or mist. In this way it is more evenly distributed over the foliage or other parts, adheres better, and if lime is used in the water there will be much less danger from injury than if used in the dry form.

Paris green alone can be safely used only at the rate of 1 lb. to 250 or 300 gals. of water. This, however, is a very small quantity, and to enable more Paris green to be used lime is added to neutralize the soluble arsenious acid. Two lbs. of lime slaked in water and added to 25 gals. of water will enable us to use as much as 1 lb. of Paris green to 100 and even 50 gals. of water without injury to the foliage. When the Bordeaux mixture (see "Fungicides") is used, the lime in that mixture has the same effect, and 1 lb. of Paris green to 50 or 100 gallons of the mixture may be used without injury to the foliage (except upon the peach and cherry trees), and the work of destroying insects and fungi thus reduced one half.

HELEBORE-POWDER.—This is a fine powder made from grinding the roots of Veratrum album, and will kill most chewing insects. It, however, is more expensive and does not adhere so well to the foliage as Paris green, even if used in lime or water. It will not, however, injure the foliage, and is not nearly so poisonous—not dangerously so unless taken into the lungs or stomach in large quantities. It is best used in water or while the foliage is wet with rain or dew.

KEROSENE EMULSION.—*Formula:* $\frac{1}{2}$ lb. common bar soap, 2 gallons water, 2 gallons common kerosene.

Dissolve the soap in the hot water; while still hot, add the kerosene and churn back and forth with a garden-pump or syringe until a soft soap or cream-like substance is formed. When cold, dilute with water to make from 10 to 25 gals. of liquid. This is used for the destruction of sucking insects like aphides (plant-lice), scale insects, etc.

WHALE-OIL SOAP is very frequently used as an insecti-

cide at the rate of from 1 lb. to 3 to 5 gals. of water, according to the insect.

PYRETHRUM OR PERSIAN INSECT-POWDER.—This substance is made from the flowers of two or three species of pyrethrum or feverfew-plants, the flower-heads of which are ground to a fine powder, known in the markets as pyrethrum, Dalmatian, Persian, or Buhack insect-powder. When dusted upon some kinds of insects in the latter part of the afternoon or evening, it will paralyze them and those remaining under its influence during the entire night are killed. Many of these insects would soon recover if it were applied in the morning or middle of the day. Young insects are more susceptible to its effect than older ones, but as most of the aphides and other sucking insects are short-lived, several applications at intervals of a few days or a week will destroy most of them.

Fungi or Fungous Growths.

The use of fungicides becomes necessary to protect many of our trees and shrubs from fungous growths, i.e., mildews, rusts, blights, etc., which often do serious injury, and copper in one form or another is the substance most commonly used to destroy these pests. When once a fungous growth has become established in the tissues of a plant, nothing will kill or dislodge it that will not destroy the host plant, but the spores or seeds of the fungus may be killed or be prevented from germinating by a very small amount of copper solution coming in contact with them.

To prevent the growth, therefore, of the spores of rusts, smuts, mildews, etc., it becomes necessary to have the copper solution on the parts of the plants likely to be

affected whenever the spores come in contact with the plant under conditions of *high temperature and moisture*. These spores are produced in immense numbers, an illustration of which may be seen in mass of spores forming the large fruit-bunches of the "corn-smut" or the dust of the puff-ball, the black substance of the first and the fine gray powder of the last being composed of myriads of spores or seeds. These spores are very small, so small in fact that they are individually scarcely perceptible to ordinary vision and are carried about by the slightest breath of air.

Much may be done to prevent the growth of fungous pests by keeping the trees or plants in a vigorous, healthy growth. This may be done by good cultivation and an abundance of plant-food, under which condition the growing spores are not so likely to gain a foothold in the tissues of the host plant; but even with the most vigorous growth we sometimes find that if the weather is unusually hot and the atmosphere very moist the spores will gain a foothold and we must have the copper solutions on the surface of the plant to prevent the growth of the spores should the plant not be able to withstand their attack.

Some seasons, and often for a series of years, our trees escape injury from fungous pests, but we cannot hope to escape always, and it is the part of wisdom to learn with what pests we are threatened, what is the best remedy, and how and when to apply such remedies as to most certainly destroy each pest.

Fungicides.

(Fungus-destroyers.)

COPPER SULPHATE (*Blue Vitriol*).—Copper has long been known to be destructive to the spores of nearly all kinds of

moulds, mildews, rusts, etc., but not until within a few years has it been largely used for the purpose of destroying these growths on cultivated trees, plants, and farm crops. The form in which it is most used is that of copper sulphate or blue vitriol, in which the copper is united with sulphuric acid and is in the form of blue crystals. In this form it is very soluble and very injurious to the growing parts of plants unless used in a very dilute form; 1 part of copper sulphate to 1500 or 2000 parts of water being as concentrated as it can be used without injury. In this form it is quickly washed off by heavy rains and to prevent this lime is used with it, forming what is known as the

BORDEAUX MIXTURE.—*Formula*: 4 lbs. copper sulphate, 4 lbs. caustic (unslaked) lime.

By combining the copper and lime it is found that the copper sulphate may be used more freely and with less injury than if used alone, and that it will adhere a long time to the foliage. To make the Bordeaux mixture, dissolve the copper in hot water (or if placed in a coarse sack or basket and suspended in a tub of cold water it will dissolve in two or three hours, while if put in cold water on the bottom of a tub or vessel it remains undissolved for a long time). Then in a separate tub slake the lime thoroughly and when both are cold pour the two together, stirring constantly. Dilute with water to make 50 gals. of liquid. In this form it is more difficult to apply than a simple solution, but the lime causes it to adhere for a long time and spraying need not be so frequently done. Before using, the mixture should be strained through a burlap or fine wire strainer to take out the coarse particles of lime. The Vermorel or some other adjustable nozzle that will throw a very fine spray or mist must be used to distribute the

material evenly and without waste over the surface of the plants.

If insects are found attacking the plants to be treated for fungous growths, Paris green may be added to the Bordeaux mixture at the rate of from 1 lb. to 100 or 200 gals. of the mixture, and, as stated on a previous page, the lime will prevent this large quantity of the Paris green from burning the foliage and two pests be destroyed at one spraying.

AMMONIACAL CARBONATE OF COPPER.—In conspicuous places the Bordeaux mixture is objectionable on account of the deposits of lime and copper that remain on the foliage, and therefore the above form of copper is used under such conditions. It is equally effectual with the Bordeaux mixture while it remains on the plant, but, being quickly soluble, is washed off with heavy rains and requires frequent renewals. It is also more expensive than the Bordeaux mixture.

Formula: 3 oz. copper carbonate, 3 qts. ammonia or sufficient to dissolve the copper, the quantity depending upon its strength. When used, dilute to make 25 gals. of liquid.

COPPER-SULPHATE SOLUTION.—A simple solution of copper sulphate, 4 oz. to 50 gallons, is about equally effectual with the last and much less expensive. It must, however, be used after every rain.

Pumps, etc., for Applying Insecticides and Fungicides.

For the application of insecticides and fungicides there are a great many pumps, machines, and guns made for the purpose, and any of those made by reliable and long-established firms may be relied upon to do good work. In every

case it is desirable, if possible, to obtain a pump made as near home as possible, that parts may be replaced or repairs be made in case of breakage with as little delay as possible.

Nozzles.

The number of nozzles made for distributing insecticides and fungicides is almost as great as that of pumps, and there are many good ones. To do the best work the nozzle must discharge a fine mist-spray that will settle upon the foliage and other parts sprayed in very small particles and not run off. The one that gives the finest spray without clogging is the most satisfactory.

To carry the spray to the tops of trees of medium height the bamboo extension-rod or $\frac{1}{2}$ -inch brass pipe from 6 to 10 feet long can be used with success, but to carry it into very tall trees the hose must be carried up into the tree and the insecticides or fungicides distributed therefrom. With a large pump worked by two or three men or a small engine two or three streams may be thrown at once and the work be done rapidly and cheaply.

Some Common Insects Injurious to Ornamentals.

ELM-BEETLE (*Galeruca xanthomelæna*), Fig. 154.—This insect (*k*), a beetle of yellowish-brown color, about $\frac{1}{4}$ inch long, somewhat resembling the striped cucumber-beetle, appears in the perfect or beetle form in early summer and lays its eggs on the under side of the leaves as they unfold. These eggs are bottle-shaped, of orange color, are laid in clusters of from 5 to 20, and attached to the leaf by the larger end (*e*). The eggs soon hatch, and the larvæ (*g*), of a slender form, about $\frac{1}{2}$ inch long when fully grown, and yellowish-brown color with a yellow line or band along the back, feed rapidly and in from two to four weeks descend to the ground, where

they pupate under some convenient shelter. In some sections of the country as many as three or four broods are

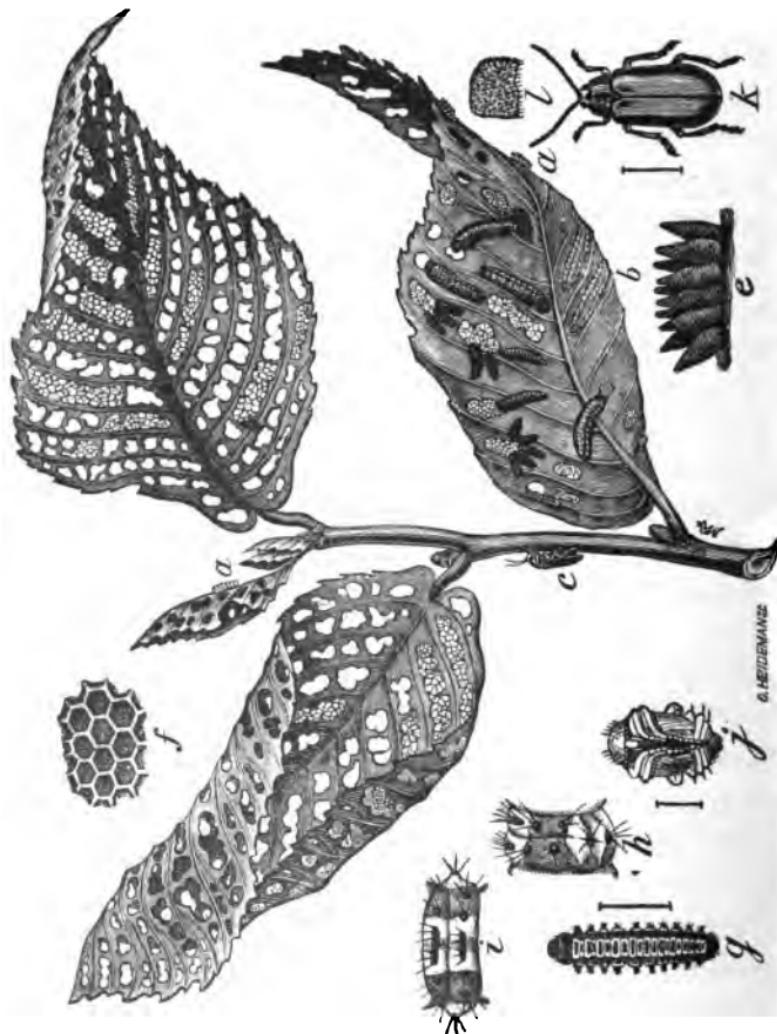


FIG. 154.—ELM-BEETLE.
(Riley: Annual Rep. Dept. Agr., 1883, Plate XII. FIG. 3.)

produced in a season, but in northern New England it has not been proved that more than one brood matures.

Remedy.—This pest is destroyed by spraying with Paris green, 1 lb. to 200 gals. of water, or if 2 lbs. of caustic lime

be slaked, strained, and put into the water 2 lbs. of Paris green may be used with the same amount of water, i.e., 1 lb. to 100 gals. of water. The time for spraying is the last of May or early in June for the destruction of the

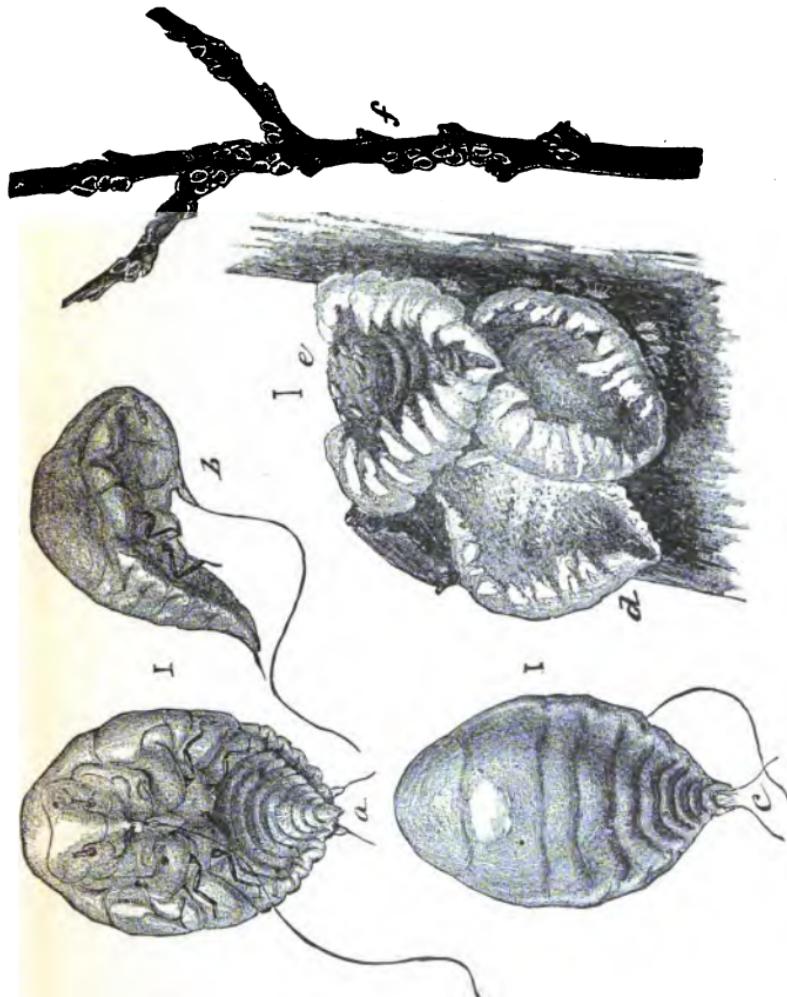


FIG. 155.—ELM-SCALE.
(Howard: "Insect Life," Vol. II, p. 37, Fig. 2.)

beetles, and again about the middle of June for the larvae, and if all the larvae are not destroyed by the first spraying one or two more applications at intervals of a week or ten days must be made.

ELM-SCALE (*Gossyparia ulmi*), Fig. 155.—Very little seems to be known about the life-history of this insect, and yet it is one of the most widely distributed and injurious insects attacking the elm. It is a small, soft scale insect of a whitish color (*f*) that attacks both the American and European species of the elm. It is found on the under side of the branches, and when crushed leaves a stain on the fingers or clothing much like that of iron-rust. It injures the trees by sucking the juices of the young shoots and small branches. In many sections in Massachusetts they were so abundant during the season of 1895 that the leaves and bark of almost every tree were badly covered with a black substance resulting from the dust of the atmosphere adhering to the sticky exudations made by the insects deposited upon them, and from a black fungous growth similar to that found in the exudations of the pear-tree Psylla in our pear orchards. The leaves were also of a sickly yellow color and the trees made a very small growth.

Remedy.—It has been found to be destroyed by the kerosene emulsion, applied thoroughly at the time when the young are hatching out and moving from near the parent scale to other parts of the tree for permanent location, and again from five to ten days later. By close attention about June 1st the best time can be easily determined.

MAPLE-BORER (*Plagionotus speciosus*), Fig. 156.—In most sections where the sugar-maple thrives this insect is more or less injurious, though it is said to sometimes attack other species. It is a very dangerous insect enemy, because its work is difficult to detect until serious harm has been done. The perfect insect is a beetle nearly an inch long, the head is yellow, the thorax black, with transverse yellowish spots, and the wing-covers are yellow and black. The beetles

appear in July and August, and lay their eggs on the bark during the latter part of the last-named month. The eggs soon hatch and the larvæ or young work a short distance under the surface of the bark, the first season throwing out chips and droppings from their holes. If not molested, the following season they go on feeding and working deeper



FIG. 156.—MAPLE-BORER.

(Saunders: 5th Report U. S. Ent. Com., p. 375, Fig. 187.)

through the bark and sapwood, making a tortuous burrow not far from the surface, often nearly $\frac{1}{2}$ of an inch in diameter and sometimes girdling the tree. As many as twenty have been found in a single tree.

Remedy.—The only effectual remedy is to dig the borers out before they have done much harm, i.e., the first fall or following spring after the eggs are laid. This may be very easily done with little or no injury to the tree. The bark should be carefully scraped and after a few days the surface carefully examined, when the exuded dust or chips will enable one to quickly detect the location of the borer. If the insects have already done serious harm to the tree, all holes or channels made by them should be filled up with putty, grafting-wax, or a thick paint. Possibly the painting of the trunk with lime or Portland-cement wash containing Paris green at the rate of 4 oz. to the gallon may

prove effectual in destroying many of the larvæ as they work their way into the tree.

CANKER-WORMS (*Anisopteryx pometaria* and *Palaeacrita vernata*), Figs. 157 and 158.—These insects extend over a



FIG. 157.—CANKER-WORM.

(Riley Circular No 9, 2d Series, Dept. Agr., Fig. 1.)

wide area of the country, and are very injurious to the elm, apple, and some other trees. The male (a) insect is a grayish moth of about $\frac{1}{2}$ inch stretch of wings and flies in the night, while the female (b) has no wings. The female crawls up the tree and lays its eggs in clusters on the branches during the night at any time from October 15th to April 15th *when the ground is not frozen and in warm, moist nights*. The eggs hatch out about the time the buds unfold, and unless destroyed the larvæ soon eat all of the leaves but the skeleton and midrib, giving the trees the appearance of a fire having burned off the foliage.

Remedy.—The remedy so generally used of putting bands of tar or printer's ink, or of tin or other kind of troughs with oil in them, around the trees to prevent the female insects from reaching the branches is effectual *provided the band is kept covered with soft ink or tar or the trough is well filled with oil when the insects are moving, i.e., at any time when there is no frost in the ground, on warm nights from November 15th to April 15th.* The more satisfactory remedy, except for very tall trees, however, is to give the insects no attention until the eggs begin to hatch out, and

then to destroy the larvæ by spraying with Paris green used as for the elm-beetle, making two applications, one when the first eggs hatch and then again in from five to eight days, according to the weather, or when all of the eggs are hatched out. Success in this work depends upon how much Paris green is used and how thoroughly the foliage is covered with it. For the amount of Paris green to use and method of application see "Treatment of the Elm-beetle," pages 269 and 270.

BORERS.—The maple-borer, Fig. 156, has already been described, but there are many ornamental trees besides the

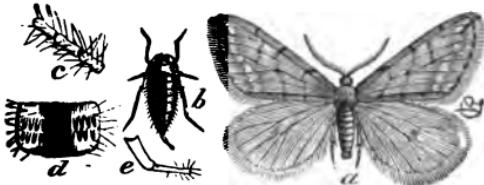


FIG. 158.—CANKER-WORM.

(Riley : Circular No. 9, 2d Series, Dept. Agr., Fig. 8.)

maple that are injured by borers. The thorns, flowering apple, and some other trees are injured by the ROUND-

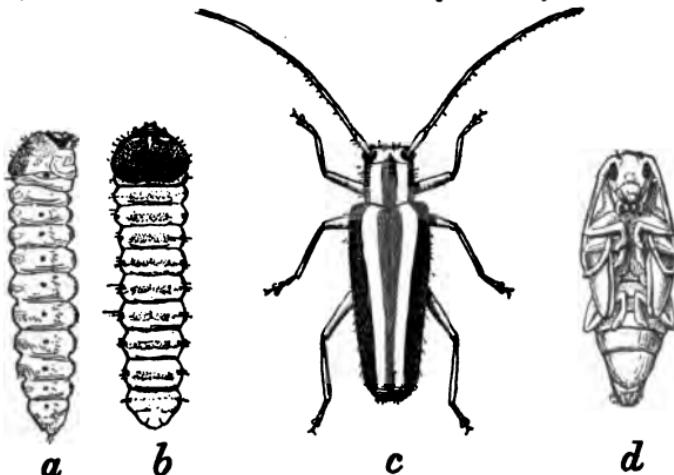


FIG. 159.—ROUND-HEADED APPLE-BORER.

(Chittenden : Circular No. 32, 2d Series, Dept. Agr., Fig. 1.)

HEADED APPLE-BORER (*Saperda Candida*), Fig. 159, and the FLAT-HEADED BORER (*Chrysobothris femorata*), Fig. 160;

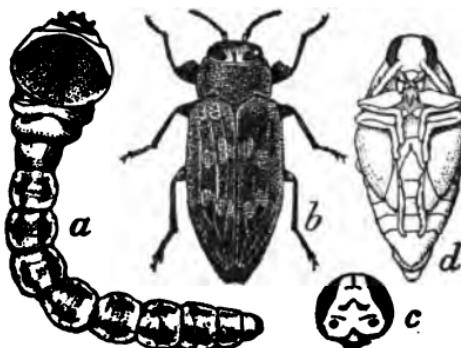


FIG. 160.—FLAT-HEADED APPLE-BORER.

(Chittenden : Circular No. 32, 2d Series, Dept. Agr., Fig. 3.)

the flowering peach, plums, and cherries are injured by the PEACH-BORER (*Sannina exitiosa*), Fig. 161. Willows,

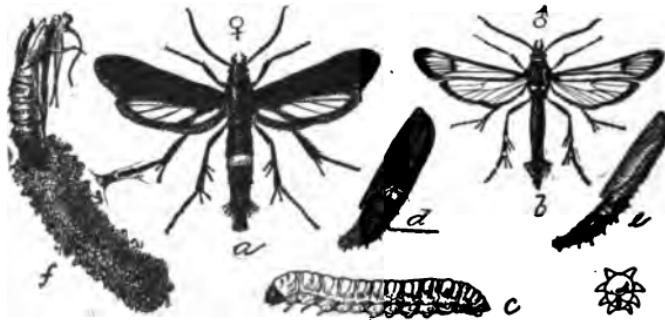


FIG. 161.—PEACH-BORER.

(Marlott : Circular No. 17, 2d Series, Dept. Agr., Fig. 1.)

lindens, poplars, locusts, and many other trees are also injured by borers. These are to be destroyed in the same manner as the maple-borers, i.e., by digging them out, carefully examining all trees twice each season—in June and August.

ROSE-BUG OR -CHAFER (*Macrodactylus subspinosus*),
Fig. 162.—This insect needs no description, and no one

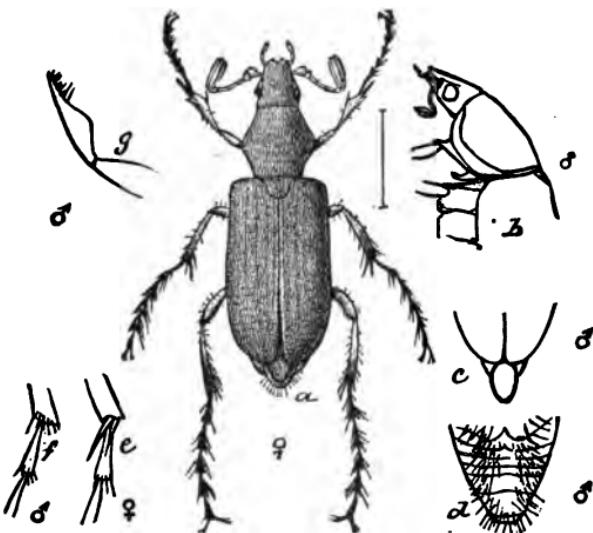


FIG. 162.—ROSE-BUG OR -CHAFER.

(Riley : "Insect Life," Vol. II., p. 295, Fig. 61.)

insect is more injurious to so many kinds of trees and shrubs and none more difficult to destroy or prevent from doing much harm.

Remedy.—Where Paris green can be safely used, as it can be upon all trees and plants producing flowers that are not cut for house or personal decoration or that produce no edible fruit, this is the most certain remedy. On roses it can be used until the blossoms are nearly open and longer if the flowers are allowed to remain on the bushes until the petals fall. Pyrethrum-powder dusted over the bushes each forenoon and again in the afternoon in bright weather will drive the beetles away, but they soon return and the remedy must be repeated each day until they are done working. If this powder has been kept over one season or a consider-

able time in an open package, it loses its strength. It should always be kept in a sealed can or glass-stoppered bottle, and a fresh supply be obtained each season. Where rose-bushes are but few, these insects can be kept from doing serious injury by hand-picking; the easiest way to gather them being to take a broad, shallow tin basin, put in a little water with a tablespoonful of kerosene on top, hold the basin under the part of the bush examined, and touching the insects they will fall into the pan and be destroyed.

ROSE-SLUG (*Monostegia rosea*), Fig. 163.—The rose-slug

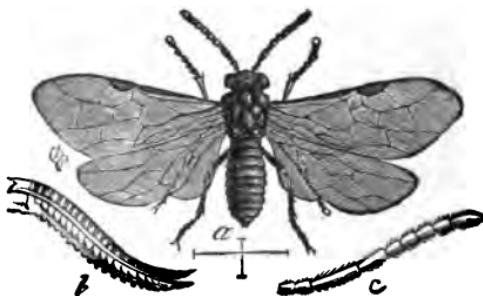


FIG. 163.—ROSE-SLUG.

(Riley : "Insect Life," Vol. V., p. 274, Fig. 37.)

is the larvæ of one of the saw-flies. The perfect insect comes out of the ground the last of May or early in June. The eggs are laid under the epidermis or skin of the leaf, and the larvæ appear in about two weeks, feeding upon the soft green parts of the leaf and leaving nothing but the midrib, veins, and epidermis on one surface. It is of a greenish color, nearly transparent, the head much larger than the posterior part of the body. It feeds rapidly and must be attended to soon after the eggs hatch.

Remedy.—Dusting or spraying with hellebore or pyrethrum-powder is a certain remedy. If the dry powder is

used, it must be applied when the foliage is wet with rain or dew. When used in water, 1 tablespoonful to a common 2-gal. pail of water is about the right quantity.

ROSE-LEAF HOPPER (*Typhlocyba rosea*).—This insect is small, almost white in color, and flies or jumps about whenever the trees or bushes are suddenly jarred. It feeds upon the green coloring-matter of the leaf, sucking out the juices, making very numerous small white spots until the leaf becomes very light green or almost white. It is especially injurious to the rose, grape-vine, etc., though it attacks some other shrubs and trees.

Remedy.—The remedy is thorough spraying with kerosene emulsion, or by the use of pyrethrum applied just at night it may be kept under control.

RED SPIDER (*Tetranychus telarius*).—This insect is so minute as to be difficult to detect with the naked eye except by the closest inspection until it has done considerable mischief, when its work is shown in the light green or grayish color of the leaves attacked. It works only in very dry and hot weather, when it increases very rapidly and attacks a great many kinds of trees and shrubs under the above conditions.

Remedy.—As this insect cannot exist in a moist, cool atmosphere, the spraying of the trees with cold water applied with considerable force is a certain remedy, a heavy thunder-shower often completely checking their work. Dusting the foliage with flowers of sulphur when the leaves are wet will also have a beneficial effect.

APHIDES (*Aphis sp.*).—There is hardly a species of tree or shrub that is not more or less affected by aphides (or *plant-lice so called*), yet but few of them are seriously injured. One season they are abundant and do much harm,

and another very few and do little injury. These insects increase with astonishing rapidity; a single pair, it is said, may be responsible under favorable conditions of food and temperature for more than 1,000,000,000 progeny in a single season. They injure plant-tissues by sucking the juices of the tender parts, and when numerous all of the terminal shoots are stopped in growth and the tree or plant has a stunted, sickly appearance. When the leaves alone are attacked, they curl and roll up, and are soon covered with black substances collected from the dust of the atmosphere coming in contact with the sticky surface caused by the exudations of the aphides.

Remedy.—The application of kerosene emulsion with force enough to drive it under the curled leaf is the most satisfactory remedy. If very abundant, the 10-gal. formula should be used. On small trees and shrubs, where the branches can be bent down, dipping the ends into the emulsion would be most satisfactory, or the strong solution may be applied with a soft paint-brush.

SCALE INSECTS.—Scale insects are among the most destructive of the sucking kinds, and several species are very abundant. Among those most to be feared are the OYSTER-SHELL SCALE and the SAN JOSÉ SCALE. The former (*Mytelaspis pomorum*), Fig. 164, is very common on ash, willows, lilacs, hawthorn, and on the flowering apples. In shape it resembles the oyster-shell, is of a brown color, about $\frac{1}{2}$ of an inch long by $\frac{1}{8}$ wide, and injures the tree by sucking the juices from the growing shoots and branches. At *c* it is shown natural size. The eggs hatch out from under the parent shell the last of June or early July, and the young swarm out and soon fix themselves on other branches, feeding at this point until they reach full size,

when they die, leaving the young or eggs protected by their dead bodies.

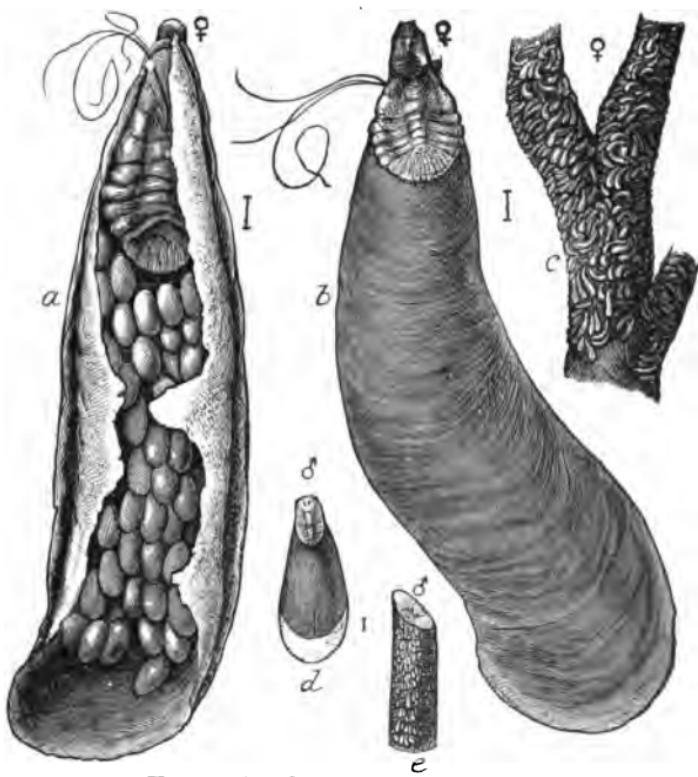


FIG. 164.—OYSTER-SHELL SCALE.

(Howard: "Year Book," Dept. Agr., 1894, p. 257, Fig. 26.)

Remedy.—This pest may be destroyed by painting during the winter with a very light coat of linseed-oil, by washing with strong caustic potash, 1 lb. to 2 qts. water, by strong whale-oil soap, 2 lbs. to 1 gal. of water, applied while the trees are dormant, or by kerosene emulsion used just after the young insects have left the cover of the parent scale and have a very delicate covering.

The SAN JOSÉ SCALE (*Aspidiotus perniciosus*), Fig. 165, so destructive to all kinds of fruit and many ornamental

trees in California and the South, has been largely distributed about the country, having been found in 16 of the

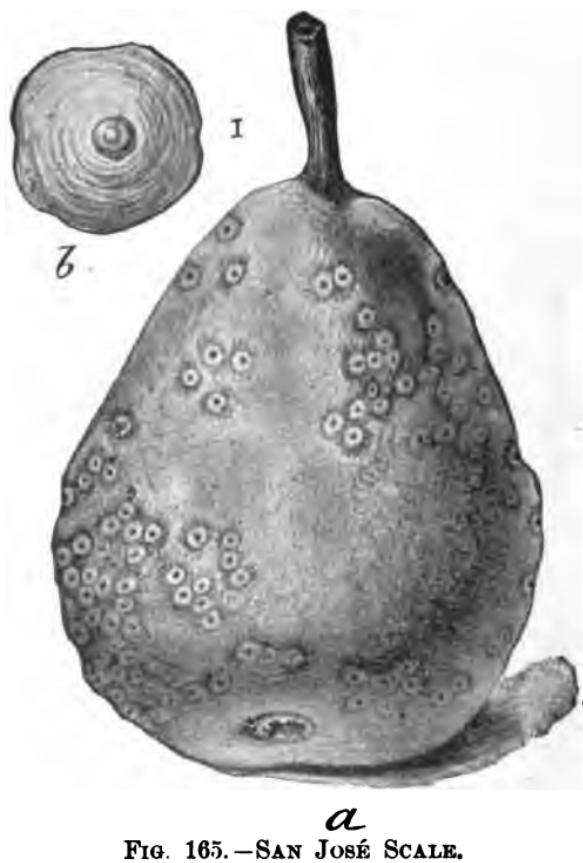


FIG. 165.—SAN JOSÉ SCALE.

(Howard : "Insect Life," Vol. VII., p. 235, Fig. 28.)

45 States, and may prove a troublesome pest unless at once destroyed. The perfect insect is circular in outline, of a gray color, varying from $\frac{1}{60}$ to $\frac{1}{16}$ of an inch in diameter, and generally with a black spot in the centre. It is so small as to escape notice until it has increased to great numbers and it propagates very rapidly. It injures plant-growth in same way as the last by sucking the juices of the

tender parts. There are many species of scale insects so closely resembling this pest that when insects of this kind are found they should be sent to the experiment station entomologists for identification and suggestions as to remedies.

Remedy.—This pest has been destroyed in some cases by the same, but more concentrated, remedies as used for the oyster-shell scale. The applications should be made more thoroughly and more frequent use of the kerosene emulsion during the summer. Clear kerosene sprayed upon the branches in a fine mist, so that no drops may be formed, while the trees are dormant, has proved effectual in destroying the pest. In using clear kerosene care must be taken that no drops are formed or that it does not run down the branches. It is best always to use it on a clear bright day, that it may evaporate rapidly and before any injury is done.

MAPLE WOOLLY SCALE (*Pseudococcus aceris*), Fig. 166.
—This comparatively new insect pest has appeared in several sections of the country, but thus far has been found only on the soft maples. In Europe it is reported to be injurious to the linden, elm, chestnut, etc. (see " Bulletin N. H. Ex. Station, No. 36 "), and should it increase in this country will prove a very troublesome pest. It is somewhat of the nature of the scale and aphid, sucking the juices of the plant upon which it feeds; its body and the masses of eggs which it lays being covered with a white cottony or woolly substance, from which it takes its name.

Remedy.—While no experiments have been made, or at least reported, to prove the value of the various common insecticides in destroying this pest, from the nature of the

insect it seems probable that the kerosene emulsion will be effectual if applied with considerable force so as to throw it

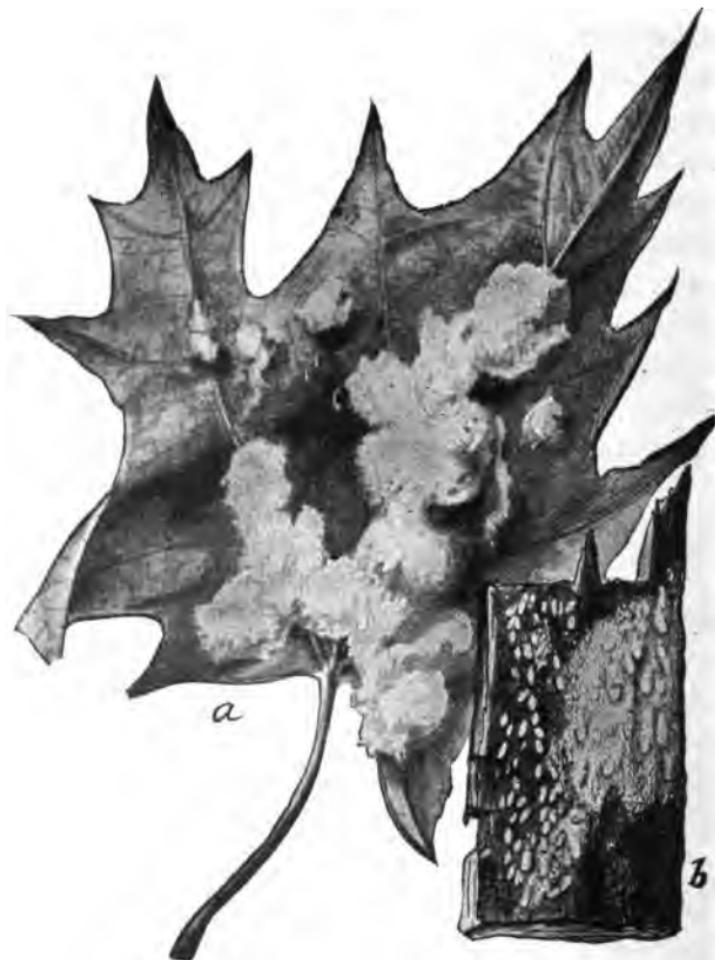


FIG. 166.—MAPLE-SCALE.

(Howard : Circular, No. 3, Dept. Agr., 2d Series, Fig. 1.)

in under the mass of insects and eggs which are so nicely protected by the woolly cover that is of a somewhat oily nature, thus preventing watery liquids from adhering or penetrating to the bodies of the insects or masses of eggs.

There are a great many other less injurious insects that often appear in small numbers on single trees or within limited localities, sometimes increasing rapidly for a time and then disappearing; but the limits of this volume will not allow of further space for their description. We may briefly say that in a general way the remedies already described may be applied to all insect pests, i.e., all chewing insects to be destroyed by the use of Paris green and all sucking insects by the kerosene emulsion.

Whenever a new insect appears, if doing harm to any crops, specimens should be sent to the entomologist of the experiment-station of the State in which it is found, and the instruction given for its destruction be followed. These stations are established for the purpose of aiding the people to overcome all difficulties in the growth of ornamental or useful crops, and every citizen should be free to ask for instruction and aid whenever needed.

Fungi Injurious to Ornamental Trees, Shrubs, etc.

The fungous growths that are injurious to growing plants belong to the group of plants known as parasitic fungi and take their food from their host plant, i.e., the plant upon which they grow, but organize no plant-food for themselves, and often they feed and grow with such rapidity as in a short time to destroy the host plant or seriously weaken it. Most of these parasites propagate from very minute seed-like bodies already described. They grow under favorable conditions with the most incredible rapidity, as may be illustrated by the short time in which the leaves of a pear or poplar tree are destroyed by the pear-blight or the poplar-rust. It often takes but a few days of warm, moist weather to cause the destruction of all of the leaves of many trees, when perhaps the growth of

but a few spores only began the work of destruction. It is during hot, moist weather that they grow most rapidly, and while we may sometimes escape if we do not use fungicides, the wise gardener will be prepared to make the application of the fungicides described on previous pages.

Among the many fungi injurious to ornamental trees, shrubs, etc., the following are among the most destructive:

RUSTS.—This term has been applied in more or less of an arbitrary manner to a large group of fungi that produce masses of spores on the surface of the leaves, generally yellowish or brownish in color, but when of a white color they are often called the "white rusts" or mildews. The spores germinate on the surface of the leaves, their roots or feeding-parts (called mycelia) penetrate the leaf through the stoma or breathing-pores, and after feeding and developing for greater or less time, according to the species or the condition of the weather, fruit (spores) is produced on stalks or in masses on the surface of the leaf, these spores being scattered by the slightest breath of air. Of the true rusts I shall mention only a few of the most important, with the remedies most effective, but many others of a similar character may be destroyed or prevented from doing harm in the same manner.

POPLAR-RUST (*Melanosporium populi*), ROSE-RUST (*Phragmidium mucronatum*), HOLLYHOCK-RUST (*Puccinia malvæorum*), LINDEN-RUST (*Cercospora, microspora*).—The growth of all of these pests takes place under about the same conditions, i.e., a weakened growth of the tree or plant from any cause and in close, moist, hot weather. Strong-growing, healthy plants are less liable to attack than those of a weak growth, though a too vigorous and soft growth may be produced by too much enrichment of

the soil, which is as much to be avoided as the other extreme.

Remedy.—If copper in even minute quantities is on the leaves and branches so that it will be distributed over the surface whenever it rains or is wet with dew the spores cannot germinate, and the remedy to apply is to spray the branches thoroughly with copper sulphate, 1 lb. to 25 gals., or strong Bordeaux mixture, before the leaves unfold, when all of the earlier spores upon them will be destroyed. Then if the trees are where the latter mixture will not be too conspicuous that may be applied at intervals of from two to four weeks through July and August. If the trees are in a very conspicuous place, the dilute copper sulphate, 1 lb. to 250 to 300 gals., may be used, or the ammoniacal carbonate of copper will be equally effectual if applied more frequently—as often as every two weeks and after heavy rains. The great advantage of the Bordeaux mixture is that it holds the copper firmly to the leaves and with every rain or heavy dew minute quantities are dissolved and the spores are prevented from germinating.

LEAF-BLIGHTS.—The leaf-blights are unlike the rusts in that they attack and destroy small portions of the leaves, and when these spots or places of attack become numerous the whole leaf is destroyed and it soon falls off. Among the most destructive of the leaf-blights are the CATALPA-LEAF SPOT (*Phyllosticta catalpæ*), CHERRY- AND PLUM-LEAF BLIGHT (*Clyindrosporium pade*), MAPLE-LEAF SPOT (*Phyllosticta acericolor*), SYCAMORE-LEAF BLIGHT (*Glaeosporium nervisequum*), ROSE-LEAF SPOT (*Actinonema rosæ*), etc.

Remedy.—As with the rusts, the copper must be on the plants to destroy the spores when they come in contact with

it, but when the parasite has become fully established nothing will destroy it that will not destroy the host plant. The treatment is the same as for the rusts.

MILDEWS OR WHITE RUSTS.—As the name indicates, these are parasites which produce white spores and more or less white patches on the leaf or other parts. As with the two previously named groups, they grow under conditions of moisture and hot, moist weather, and as a rule they appear later in the season.

Among the most destructive of this group are the ROSE-MILDEW (*Sphaerotheca paunosa*), POWDERY MILDEW OF THE HAWTHORN, PLUM, AND CHERRY (*Podosphaera oxyacanthæ*), DOWNY MILDEW OF THE WILLOW (*Uncinula adunca*), DOWNY MILDEW OF THE LILAC (*Macrosphara Friesii, var. syringæ*), etc.

Remedy.—Coming on later in the season than the brown rusts, two or three applications of either the Bordeaux mixture, dilute copper sulphate, or the ammoniacal carbonate of copper will be effectual, but no application need be made generally until the middle or last of July.

Flowers of sulphur if dusted over trees and shrubs will often reduce the mildews, but not often wholly destroy them.

As with new insects, fungi new to any individual that may appear to be doing serious harm may be sent to the experiment stations for identification or for suggestions as to the best remedies.

CHAPTER XVI.

THE HOME FRUIT-GARDEN.

IN Chapter II some of the advantages of the fruit- and vegetable-garden to the owner of a home were briefly mentioned, and as the aim of this book is to give practical information along all lines of outdoor home ornamentation and comfort, a chapter on fruits will not be out of place, for the fruit-garden may be made to serve also as an important feature of the home ornamentation. What can be more beautiful than fruit trees when in bloom, or again when laden with highly colored fruit?—and they may be trained to as perfect and beautiful forms as many of the trees used only for ornament.

The shade afforded by a broad-spreading apple-tree is quite as dense and satisfactory as that from many other species. In the frontispiece is shown a large spreading apple-tree on the right of the picture which has afforded delightful shade during the summers for a quarter of a century, and, fruiting every alternate year, has yielded several times 10 bbls. of choice fruit in a single season. The fruit that is obtained from the home garden is so much superior to that obtainable in the markets that it is worth a great effort and considerable annoyance to have on one's table an abundance of such choice, fresh, ripe fruit.

Size of the Fruit-garden.

The amount of land to be devoted to the fruit-garden must depend very much upon size of the lot, the number and locality of the buildings, and the amount of other ornamentation attempted. For the supply of a large family with a liberal amount of all the fruits in their season will be required a garden of considerable area, though it is surprising what a quantity can be grown on a small area when skilfully managed. An estimate of what will be the average yield of the different kinds of fruits under the best conditions is as follows:

Apples, per tree, 30-40 ft. apart, at 15 yrs. from planting,	3 bbls.
Pears, " " 20 " " 12 "	" 3 bu.
Plums, " " 15 " " 10 "	" $\frac{1}{2}$ to 1 bu.
Peaches, " " 15 " " 6-15 "	" $\left\{ \begin{array}{l} \frac{1}{2} \text{ bu. in N.} \\ \text{E.; 1-2 bu.} \\ \text{so. of N.Y.} \end{array} \right.$
Cherries, " " 20 " " 8 "	" 1 bu.
Quinces, " " 12 " " 8 "	" 1 bu.
Grapes, per vine, 8 by 10 ft. apart, at 3 yrs. from plant- ing	5 lbs.
Raspberries and blackberries in rows 7 ft. apart, at 3 years from planting	1 bu. per sq. rod.
Currants and gooseberries, 3 by 6 ft. apart, at 4 years from planting.....	$1\frac{1}{2}$ bu. per sq. rod.
Strawberries in rows 4 ft. apart, at 1 year from planting.....	1-3 bu. per sq. rod.

Location.

In locating the fruit-garden that part of the lot with a suitable soil should, if possible, be selected, and be

THE NEW YORK
PUBLIC LIBRARY

ASTOR, LENOX AND
TILDEN FOUNDATIONS.

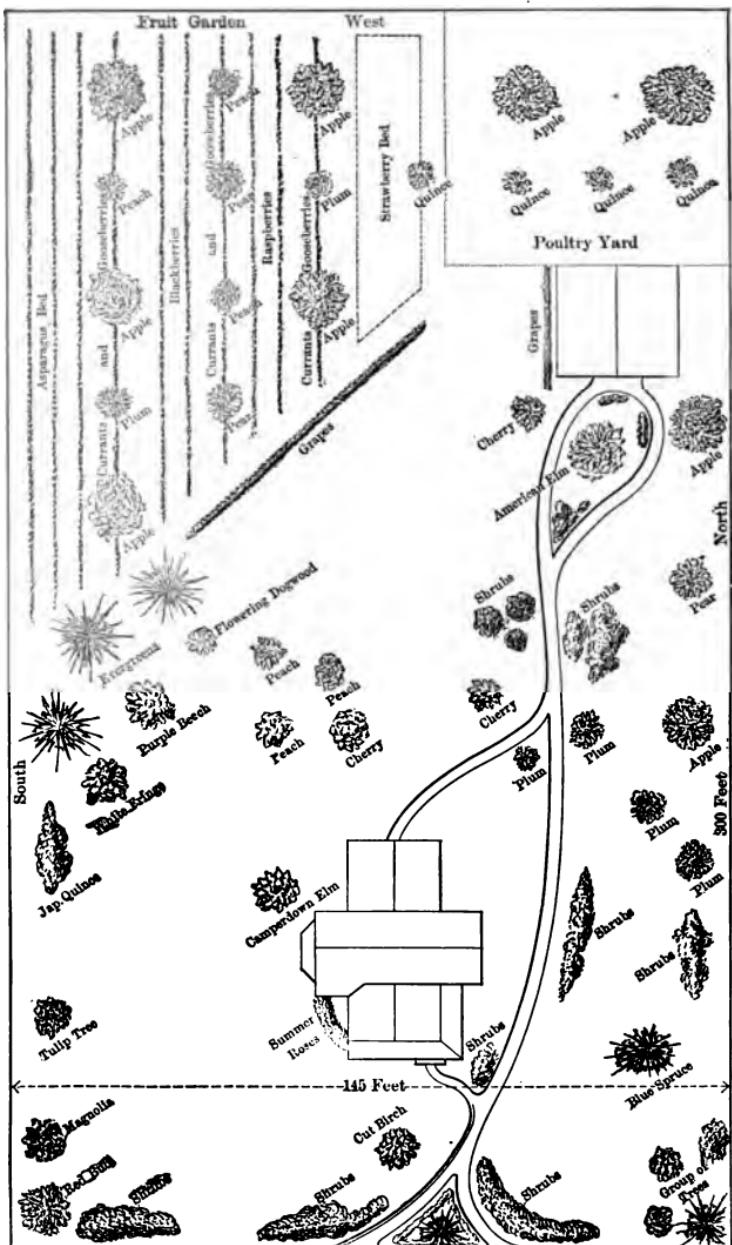


FIG. 167.—THE HOME FRUIT GARDEN.

(To face page 291.)

located in a rather secluded part, as more or less of the material used and some of the crops grown are not of a distinctly ornamental character in all stages of growth; besides, some seclusion is desirable when carrying on the work of planting, cultivating, fertilizing, or even harvesting the products. Fig. 167 illustrates the fruit-garden located in the southwest corner of the lot.

In this garden the large and small fruits may be grown more or less grouped together, as shown in the above figure, though for the best results each kind should be planted entirely distinct from the others. The arrangement in rows as shown in the figure is made that the work of cultivating may be largely done by the horse-plow and cultivator.

The Soil.

Much of the success of the work in the fruit-garden will depend upon the character of the soil. That which is best for the greater variety of fruits is a deep sandy loam not easily affected by drouth. Should the soil in the different parts of the garden vary, the apples, pears, quinces, and red raspberries, currants, and gooseberries should be planted on that which is the heaviest; while the peach, cherry, grape, plum, and blackberry will succeed in lighter soil. Any kind of soil, however, may be improved somewhat in character at a little expense. Thus a light soil may be made more retentive of moisture by plowing under stable manure, leaf-mould, peat, etc., while the moisture in such a soil may be conserved by deep plowing in the spring and frequent stirring of the surface-soil during the summer.

Very heavy soils may be improved by underdraining, by deep plowing, by the application of sand, or by plowing the

land into beds with rounded surfaces so that the surface-water will run off quickly.

The slope of the land also affects some crops very materially: thus a southern, southeast, or southwest slope is most favorable to the growth and maturity of the grape and to the early ripening of the other fruits, while the peach, quince, and raspberry succeed better when planted on a northern exposure.

A close sheltered place is not desirable if peaches, cherries, plums, and grapes are to be grown, as fungous diseases are more liable to attack them under such conditions than if planted upon high land. The latter is less subject to late frosts in the spring or early frosts in the fall, while in low land the fruit-buds are often destroyed by these frosts.

It will often be found that the garden selected is not suited to the growth of some of the fruits, while it is especially adapted to the others, in which case it will be found better economy to devote the space to those that do succeed, and purchase such as cannot be grown economically.

Tools.

The tools required for the cultivation of a small garden are not very numerous, and the best will be found none too good and the cheapest in the end if well cared for. They should be light and strong, and after using should always be cleaned and put carefully away where they will be ready for use at any time. If the garden is of considerable size and all the work is to be done by those on the place, the following list of tools will be needed:

1 good side-hill plow and 1 small plow.

1 Planet Jr. cultivator with its various attachments will answer all purposes for harrow, cultivator, and marker.

1 one-horse cart or wagon will be needed unless the heavy work is to be hired done.

1 seed-drill with cultivator attachment will be found a very useful tool.

Spades, spading-forks, manure-forks, square-pointed shovels, iron rakes, wooden rakes, hand-roller, garden line and hoes, in number according to the amount of work to be done. A good wheelbarrow or hand-cart will also be found useful.

A spraying-pump of some sort must be provided for the application of insecticides and fungicides. The common hand garden-pump will be sufficient if only a few trees are to be treated, but the barrel-pump will be found much more serviceable and economical.

Arrangement of the Garden.

It is generally best to have all the fruits or vegetables in the home garden grouped as compactly as possible in the rear part of the grounds, and as far from the house as possible, though this part of the grounds should be made to blend with the more ornamental features. Specimen trees of the large fruits may be grouped by themselves or among the other ornamental trees, as shown in Fig. 167. Grape-vines may also serve to ornament the buildings, verandas, or trellises that may screen the garden from too full exposure.

This plan shows the ornamental features of about an acre lot with the fruits grouped more or less in the rear of the house. In the garden proper are arranged 5 apple-trees, 40 ft. apart, with 2 pears, 2 plum, and 3 peaches, 20 ft. from

each of the other trees, planted so that all may have clean cultivation; while on the west and north border as well as in two groups between the house and barn others are located, which must be grown in turf. These more or less blend with the ornamental trees and shrubs. On the north-east border of this garden are planted grape-vines to serve as a cover to the trellis that screens the garden from the house. Raspberries, blackberries, currants, and gooseberries are planted in rows in the line of and between the trees. The strawberry-bed is located on the south side of the orchard. An asparagus-bed is also chosen on the west side.

Turf Culture.

One great advantage of close grouping, as has been stated, is that the soil about the trees and plants may be cheaply and thoroughly cultivated, thus preserving the moisture and making it unnecessary to apply as much plant-food as if they were grown in turf. If, however, the lawn is kept mown once or twice each week and a more liberal supply of plant-food is applied, the growth of the trees will be found to be satisfactory.

Should it be found necessary to plant on turf land where a hay crop is to be taken off, much less growth must be expected and a much more liberal application of plant-food be required than where the land is cultivated, and in times of drouth a mulch of hay, straw, or other material, two or three inches in thickness, should be used under the trees as far out as the branches spread to prevent serious injury.

Where to Obtain Trees and Plants.

As a rule, where only a small quantity of trees or plants is desired, it is best to buy of the nearest reliable nursery-

man who has the varieties wanted growing on his grounds. Those selected should be young and vigorous, and it will generally be better for the purchaser to go to the nursery during the growing season and make his selection, having them marked for delivery when they are wanted, or if inexperienced in such matters the selection may be left with reliable nurserymen, specifying that the stock shall be of good size, *young*, and *vigorous*. Travelling agents, unless known to the purchaser, should not be patronized.

If the local nurseryman has not the stock wanted, a specific order stating the variety, age, and size of trees or plants wanted sent in early to any of the many reliable nurserymen will be certain to receive prompt attention. If the quantity ordered is not large, such orders should be sent by express, as small packages sent by freight are often delayed in transportation.

Preparation of the Land.

If the land is new, i.e., if it has been in turf for some time or if under neglect, and the preparation can be begun in the fall, deep plowing should be done by following the common plow with the trench- or subsoil-plow, whereby the soil may be loosened from 15 to 20 inches deep. This will make a light soil more retentive of moisture and a heavy soil more porous and furnish a deep and well-pulverized bed for the roots to penetrate.

Digging the Holes for Planting.

In digging the holes for the reception of the trees, where the land has been deeply worked as above, only a space large enough to hold the roots fully spread out need be

excavated; throwing out the subsoil, however, and replacing it with good surface-soil. On the lawn or in grass land holes considerably larger than the spread of the roots should be made and the subsoil be dug up deeply or partly thrown out if poor, and be replaced with good soil. The turf removed in digging, if any, may be placed in the bottom of the holes with good results.

Preparation of the Trees for Planting.

No matter how carefully trees may be dug from the nursery, a large per cent of the fibrous roots will be destroyed and many of the larger roots be broken, and if the tree is planted without the removal of some of its branches when it starts into growth in the spring the number of buds is so great that the supply of moisture from the roots will be insufficient to sustain a vigorous growth, and all may finally fail; while if the larger part of the branches had been removed the few buds that remain would start vigorously and sufficient moisture be supplied to sustain continuous and rapid growth until new roots and vigorous leaf-surface is formed, without which good growth cannot take place.

In pruning young fruit-trees for transplanting all branches not needed for the formation of a symmetrical head should be removed, and those remaining be shortened in more or less, according to the amount of injury to the roots. Young trees with few lateral branches are often trimmed up to a "whip-stock." This is especially the practice with peach-trees.

Planting Fruit-trees, Vines, and Plants.

The best time and the methods of planting have already been discussed on pages 53 to 61, which see. All trees should have been ordered in the fall or very early in the spring, and everything possible be in readiness for planting when the trees arrive. Trees or plants never should be planted when the soil is so full of moisture as to be sticky or compact into solid masses when pressed, but be in condition to crumble finely when turned over with the spade or plow. The subsoil thrown out in digging the holes should never be put close about the roots, but after planting be spread about on the surface and only good soil be used about the roots.

Forming the Head and Pruning.

When trees are set closely and where small fruits are planted between them, the head or main branches must be carried higher than if only trees were planted in order to facilitate comfortable working among them. The main branches in this case must be started about 5 feet from the ground. On the lawn and where nothing is grown under the trees the branches may start at 2 or 3 feet from the ground unless it is desired to have them higher for shade or for obtaining views under the branches. If used as a screen, it is desirable to have them branch from the ground up, and low-headed trees are much more easily cared for, the fruit more easily gathered, and they will generally live longer.

The amount of after-pruning required, if properly formed at planting, is very small if the trees have full exposure on all sides; and if the trees are examined several times during

the growing season perfect form may be produced with only the finger and thumb and a small pocket-knife, and this without the loss of any growth of wood, which would be the result if pruning is only done at the end of the growing season.

Up to the time of fruiting all the pruning fruit-trees properly cared for will need is that mentioned above; but after they begin to bear the branches will often droop so much as to require removal, or they may cross one another so as to be injured, but in no case should large branches be removed when it can possibly be avoided, as every cut made on the trunk or main branches of a tree will more or less shorten its life. Broken branches should be cut back to the solid wood and all dead branches be removed, but every wound made in this work should be covered at once with linseed-oil paint, or some other preservative. Where large branches must be removed, the saw should be used and never the axe, as the latter cracks the wood more or less and decay will follow much more quickly than if the saw is used. In removing large branches always cut on the under side of the branch first, that when it falls the bark may not be torn from the trunk. Suckers that come out along the main branches should be removed while they are soft and can be easily rubbed off, that the growth that would go into them if allowed to remain may go into the permanent growth of the tree.

The tops of trees that tend to grow too tall and spindling should be pinched off before they have made much growth, thus forcing the growth into the lower branches, where it is much more desired. Cuts made at the ends of the branches do little or no harm to the vitality of the tree.

Special Treatment for Growing Fruits.

THE APPLE.

This is one of the most healthful and easily grown of all of the fruits of the temperate zone. It succeeds best in a deep moist loam and begins to bear crops of some value at from 8 to 10 years from planting. For the best result it should be planted at from 30 to 40 feet apart, according to the variety and nature of the soil; such varieties as the Baldwin, King, Roxbury Russet, Gravenstein, etc., on rich land will need the larger space, while on a light soil the smaller distance may be sufficient. The Fameuse, Porter, Astrachan, etc., may be planted even on a rich soil at 30 feet apart.

The varieties that will give the best results vary somewhat in different sections of the country, and those who are thinking of planting should consult successful growers in their own vicinity. This will apply to all kinds of fruits. The author suggests the Astrachan, Gravenstein, Baldwin, Rhode Island Greening, Sutton Beauty, and Roxbury Russet as generally succeeding.

Fertilizers.

One of the most important conditions in securing good fruit is sufficient plant-food to give the tree a moderately vigorous growth and healthy foliage. To give these results on the average soil will require, according to the size of the tree, 5 to 10 lbs. fine-ground rock phosphate, sown in the fall or winter, 2 to 5 lbs. nitrate of soda, sown just as growth is beginning in the spring, and 3 to 5 lbs. of sulphate of potash, sown at any time during the winter or early spring. These materials may be mixed and sown

together or put on separately. 10 to 20 lbs. of fine-ground bone, according to size of tree and the soil, may be applied in place of the rock phosphate and nitrate of soda. 25 lbs. of hard-wood ashes with from 2 to 5 lbs. of nitrate of soda per tree will also make a good dressing.

A dressing of stable manure under the trees, at the rate of from 5 to 10 cords per acre, according to the soil, will also give a good growth. In all cases the fertilizing-materials should be spread as far as the branches extend.

If other crops are to be grown on the same land with the apple trees, as in this garden-plan, sufficient plant-food must be added to the above formulæ to provide for the growth of all. Either of the above formulas will be suited for the other fruits, used at the rate of about $\frac{3}{4}$ to 1 ton per acre, but varying them somewhat according to natural condition of the soil. If sufficient growth does not result, more fertilizer should be used, and if the growth is too great it should be reduced.

Thinning the Fruit.

The apple, like most of our fruit-trees, has the habit of producing fruit only on alternate years, which is the result of exhaustion of the tree by its large crop of fruit, and it takes one year at least for it to regain sufficient vigor to produce another crop. To overcome this condition, the trees should be allowed to bear only a moderate crop and the land be kept in a condition to produce a moderately vigorous growth of the tree. It is the practice of many of the most successful fruit-growers to thin their apple as well as other fruit-crops so that the trees will not be weakened by overbearing. This thinning is done when the fruit is about one third grown, removing all the wormy and im-

perfect fruit, and, in some cases, one half or two thirds of all on the tree. The result of this is that there will be little poor fruit to pick and sort; what remains will be larger and of better quality, while the quantity will probably be as great as if all had been allowed to remain on the tree, and the tree will not be exhausted, for it is the production of the numerous seeds that weakens the tree more than the production of the pulp or soft part of the fruit.

Insects and Fungous Pests.

The limits of this chapter will not warrant a description of the many insects and fungous pests that are injurious to the apple or the other fruits, and the reader is referred to such books as Saundier's "Insects Injurious to Fruits" and "The Spraying of Crops" by Lodeman, etc., and to the directions for the use of insecticides and fungicides on pages 262-269. On these subjects the bulletins of the experiment-stations give the best and up-to-date information that can be obtained from any source.

THE PEAR.

Although the pear is not so largely grown or highly prized as the apple, it is distinctly a home fruit and is easily grown. The trees should be planted about 20 feet apart and succeed best in a rather heavy soil, but will do fairly well on any but a very thin soil. The tree grows in a regular pyramidal form and begins bearing earlier than the apple. The treatment it requires as to preparation of tree for planting, the planting, and care are the same as for the apple and need not be repeated here.

To obtain fruit of the largest size and the best quality, the trees should make a vigorous growth and the fruit must be thinned as directed for the apple. The fruit ripens

better, is of better color and quality, if picked before quite ripe. The time for this work is indicated by the wormy specimens becoming mellow. For home use it is best to gather the fruit as it matures, each time picking the largest specimens while they are still hard. The varieties suggested as likely to be most satisfactory are Clapp, Bartlett, Sheldon, Bosc, Seckel, and Hovey.

THE PEACH.

The peach can only be profitably grown on high, rather light, well-drained land. It sometimes succeeds when planted on low land if located near the house, where the cellar wall gives perfect drainage and the building affords some shelter from severe cold, but generally unless on elevated land the buds are destroyed by severe cold in most northern sections during the winter. While it may not be advisable to plant the peach for profit on low land, the buds sometimes escape and a single good crop from a peach-tree in the home garden will well repay the labor and care of growing and the long years of waiting. Peach-trees cannot be expected to live very long in any section of the country; the average life of the trees throughout the country is probably not more than 10 to 12 years. If the land on which the trees are planted is very rich, it will be well to plant some other crop among the trees to check a too-rapid growth, especially while the trees are young, though when a crop of fruit has been set there is little or no danger of making the soil too rich. A moderately vigorous growth from the beginning to the end of the season gives the best and most hardy wood and the finest flavored fruit, and the latter should always be ripened on

the tree, if possible, as it is much better flavored than if picked before ripe.

The best distance for planting is 15 feet apart, and the varieties that probably will give the best satisfaction are Mountain Rose, Crawford Early, Crawford Late, Elberta, and Oldmixon.

THE PLUM.

Although plum-trees are found in most home gardens, there is but little profit or satisfaction in their growth unless one is skilful in caring for them. To succeed in their growth, the trees should have an abundance of room —15 by 15 feet or 15 by 20 feet—and be planted where there shall be a good circulation of air about them. The trees must be sprayed in the spring before the buds start, again as soon as the blossoms have fallen, and also when the fruit is about one half grown with the Bordeaux mixture (see page 267). Then as the fruit approaches maturity the simple copper-sulphate solution, 4 oz. to 50 gals. of water, must be used immediately after each rain until the fruit has been gathered. The black knot should be cut off as soon as it appears, and if large wounds are made they should be painted with kerosene or linseed-oil paint. If the plum-curculio is abundant, the insects should be caught by spreading sheets or a large frame under the trees and giving the branches a sudden jar with a padded mallet. Those caught may be quickly destroyed by brushing them together on the sheets and dropping them into a pail of water with a little kerosene on top.

Thorough cultivation or an abundance of plant-food must be given, especially when the trees are heavily loaded with fruit. Thinning must be practised to improve the

size and quality of the fruit and save the trees from being injured by overbearing. The fruit should be allowed to become very nearly ripe upon the trees before picking for the best quality, though for canning purposes they are sometimes picked as soon as fully grown and well colored.

The varieties that may be recommended are the Bradshaw, Lombard, Imperial Gage, Green Gage, German Prune (Fellemburg), and Damson of the European plums, and the Abundance, Burbank, and Satsuma of the Japanese plums. The last-named variety is valuable only for canning.

THE QUINCE.

Two or three quince-trees in the home garden will be often a source of much satisfaction. If there is a low place about the grounds, yet where there is no standing water with especially rich soil, the quince will succeed under such conditions. 12 by 15 feet is a good distance for planting, and it generally succeeds best where the land is frequently cultivated.

The quince is usually free from serious diseases, but in very wet and hot seasons the cedar-apple rust, leaf-blight, and fire-blight sometimes does considerable injury. Spraying thoroughly with the Bordeaux mixture before the leaves unfold and again after the fruit has set will be greatly beneficial. The flat-headed apple-borer sometimes is seriously injurious, and the trees must be examined once or twice each year and the borers dug out.

The varieties suggested are the Orange, Reas, and Champion.

THE CHERRY.

Very few persons succeed in growing the cherry on a small scale from the fact that the birds get the largest share

of the fruit, or that the fruit as it approaches maturity is often destroyed by rot if the weather is warm and moist. Very low trees, like those of the sour cherries, can be easily covered by a netting, and the birds prevented from taking all the fruit, and the use of the Bordeaux mixture while the cherries are small and the copper solution, as for the plum, while the fruit is ripening will largely prevent the rot.

The black aphis is the most destructive insect, causing the leaves to curl up and seriously checking the growth of the young shoots. The remedy for this pest is kerosene emulsion or strong whale-oil soap solution sprayed with sufficient force to reach the insects under the curled leaves.

The trees will live much longer if planted in turf land than if in cultivated garden soil, and as they make very regular and shapely trees are well suited for growth upon the lawn or by the roadside. The amount of fertilizers needed is what is just sufficient to make a fairly vigorous growth, too rapid growth often resulting in the cracking of the trunk and an early decay of the tree.

Among the best varieties may be mentioned Napoleon, Gov. Wood, Black Tartarian, and Windsor of the sweet cherries, and Early Richmond and Large Montmorency of the sour kinds. The fruit should be gathered in dry weather and be picked with the stems attached, so that it shall not be crushed or bruised; otherwise it will decay quickly after gathering.

THE GRAPE.

This is especially a home fruit, from the fact that it can be grown on a lot of the smallest size, it can be trained over the veranda or porch, upon a trellis along the side of the house or stable, on any southern exposure, and produce

a large quantity of the most delicious and healthful fruit. It succeeds best in a very warm location and in rather poor soil, but if planted where it is close and moist, with but little air and sunlight, it is sure to be attacked by mildews, rots, and anthracnose. The conditions of success in growing the grape are a moderately vigorous growth of vine well spread out to the full sunlight and air; forcing the growth into a few canes—those bearing the fruit the present season and those that are to bear the fruit the next season—all other parts of the vine being prevented from growing by pinching as soon as they have made one new leaf after the last pinching; and thinning the fruit so that the vines shall not be exhausted by overbearing. The fruit is borne on the wood of the present season's growth, and the more vigorous this growth the larger will be the size of the bunches and the quantity of fruit.

The best support for the vines to run on is made of No. 14 or 16 galvanized iron wire, as the tendrils of the vines will cling to this, it is less expensive, and the vines require less tying to keep them in place than if trained to a wooden trellis. If trained against the building, the vine should be kept six to ten inches from the wall, that the air may better circulate among the leaves and fruit thus preventing disease and the decay of the woodwork.

In very wet seasons mildew will attack the leaves, and rot and anthracnose the berries, and spraying becomes a necessity to insure a crop under these unfavorable conditions. The Bordeaux mixture should be used up to the time the fruit is one half grown, after which the copper solution must be used, making two applications of the former and three or four of the latter, according to the weather.

Among the best varieties for sections north of New York City may be mentioned Campbell's Early, Worden, Winchell (*Green Mountain*), and the Delaware. South of this latitude many other choice kinds may be grown.

THE BLACKBERRY.

Of all garden-fruits none is so easily grown and yet so often a failure as the blackberry. The conditions of success are a good new soil, if not a deep sandy loam, then a deep well-underdrained clay loam. Plant in the fall or very early in the spring in rows from 6 to 8 feet apart or in hills 4 by 6 feet, allowing a space of from 10 inches to 1 square foot for each cane, and all suckers not desired for the next season's fruiting must be treated as weeds. It is best to allow the suckers not wanted to grow 6 inches to 1 foot, and then pull them up rather than to hoe or cut them off. The critical time of growth is when the fruit is ripening, a large amount of moisture being needed to produce the best fruit, and to secure this the surface-soil should be stirred once or twice each week or a mulch of hay, straw, or other material 2 or 3 inches thick be spread over the surface. At the end of the fruiting season the old canes should be cut out and the small weak new canes be cut or pulled, so that the whole growth may be forced into the canes for the next season's growth. It is the practice of most growers to pinch the ends of the new canes when they are 3 to 4 feet high, which causes them to grow more stocky and require less support. In the more northern sections the canes are bent over and covered lightly with soil to prevent winter-killing. This is a simple matter, and the canes need not be broken if the soil is loosened a little on

the south side and they are bent over with a strong pulling motion. They should be bent over toward the south, that the sun during the winter may not strike them with direct rays, and should be uncovered and placed upright as soon as the frost is out of the ground in the spring, as they start earlier when lying on the ground than if standing upright and are thus less liable to be injured by late frosts.

To keep the canes upright when loaded with fruit, they may be tied to stakes or be supported by tying the canes in from opposite sides, one cane thus supporting the other. No. 14 or 16 wires stretched on each side of the rows from 12 to 15 inches apart serve as good supports. When grown on a strong soil, the canes if made to branch by pinching will be large enough to stand up without support.

The varieties that succeed at the north are the Agawam, Snyder, and Taylors, while further south the Early Harvest, Wilson, and Erie may prove more satisfactory.

Under good cultivation the blackberry is very little troubled by insect or fungous pests, but it will generally be best to spray the bushes before they start into growth and again just before the blossoms open with the Bordeaux mixture for the leaf-blight, rust, and anthracnose, which are sometimes destructive in very moist and warm weather, especially if the growth is rather weak.

THE RASPBERRY.

The raspberry is successfully grown under about the same conditions as the blackberry, but perhaps needs a somewhat richer soil, and as the canes make a shorter growth may be planted a little closer, i.e., in rows 5 to 6 feet apart or in hills 3 by 6 feet. The fruit of the red raspberry should be

gathered every day, for if allowed to remain long on the bushes after ripening it decays quickly in moist weather. The pruning, training, and care are practically the same as for the blackberry, and clean cultivation or mulching rather more of a necessity.

The varieties that will probably give the best results are the Cuthbert, London, King and Miller.

THE CURRANT AND GOOSEBERRY.

There is scarcely a home garden to be found in which an attempt is not made to grow the currant, but in most cases the bushes are planted in some out-of-the-way place where they suffer from neglect, and the fruit, while of some value for making jelly, is not desirable for table use because of its small size and seedy character. There is no fruit that can be improved so much in size and quality by good cultivation as the currant.

Vigorous young plants one or two years old should be planted in rich, rather moist soil in hills 4 by 6 feet apart. Thorough and clean cultivation must be given and an annual dressing of two or three shovelfuls of good stable manure be put about the bushes in the fall or an equal value of some good fruit-fertilizer be applied in the spring.

The pruning needed consists in cutting out the old wood, i.e., that more than three or four years old, in such a way as to give the bushes an upright form and produce young and vigorous wood, upon which only large and fine fruit can be grown. During the time of ripening much fruit will be saved from being spattered with soil if a mulch of 2 or 3 inches is put around under the bushes.

For home use the best varieties are the Versaillaise, Pomona, and White Imperial.

The currant-worm is the only insect seriously injurious to this fruit and unless it is destroyed will almost certainly ruin the crop. It comes on with the early unfolding of the leaves, works rapidly, and requires only a few days to completely denude the bushes of foliage. Close watch must be kept, and at the first appearance of this pest powdered hellebore must be applied while the leaves are wet or be put on in water, a large tablespoonful to a pail of water, with the watering-can or spraying-pump. A second brood of these insects appears in about two weeks from the first, when a second application of hellebore is necessary.

Spraying with the Bordeaux mixture before the leaves open, just before the blossoms open, and again after the fruit has been picked will prevent the leaf-blight that often seriously weakens the bushes.

The *gooseberry* requires the same treatment as the currant, but must be planted in a rather more airy place to prevent the mildew that often ruins the fruit. Spraying with the Bordeaux mixture will sometimes prevent this disease. If the currants and gooseberries are planted together, the first brood of the currant-worms will be found largely on the latter, while the second will be on the former only.

THE STRAWBERRY.

This is pre-eminently a home fruit, because it is so easily grown, comes into bearing at one year or less from the time of planting, and produces a large quantity of fruit that is much superior to that which may be found in the markets. All that is required for success is a deep, rich, new soil, thorough cultivation, and a good supply of moisture at the time of ripening. A yield of one bushel of fruit to the

square rod is of very common occurrence, while three or four bushels are sometimes produced under the most favorable conditions. The land should be made rich by plowing or spading under manure at the rate of from 10 to 15 cords per acre, and be made fine and mellow before planting. To this amount of manure should be added, at the rate of from $\frac{1}{2}$ to $\frac{1}{2}$ ton per acre, any good fruit-fertilizer, and after being thoroughly worked in to the surface soil the plants be set as early in the spring as the land will work up fine and mellow.

The plants—only young plants with white roots should be used—may be set in rows from 3 to 5 feet apart and from 1 to 3 feet in the rows, according to the system of growing practised. The best berries perhaps, and a large quantity of them, will be produced if the plants are set 2 feet by 3 and three rows of runners be rooted, as shown in Fig. 168, where *x* illustrates the old plants and *a* the



FIG. 168.

new plants. After the bed or row has thus been established all other runners must be pulled or cut off as soon as started, and the land be kept clean cultivated up to the time the ground freezes in the fall.

During the winter the bed should be covered with a light mulch of hay, straw, or other material *free from weed-seeds* to prevent the alternation of freezing and thawing when the ground is not covered with snow. In the spring after growth begins this covering should be drawn from the crowns of the plants into the space between the rows, where

it will serve as a mulch and protect the fruit from becoming covered with dirt during heavy rains.

All weeds that appear in the spring must be pulled out by hand, as stirring the soil with the hoe at this time is not advisable.

The varieties are so numerous and vary so much under different kinds of soil and location that no list of varieties of much value can be given that will be successful in all locations, and the reader should consult some successful grower in his vicinity and plant the varieties found most valuable. The varieties suggested that may be generally satisfactory are the Clyde, Brandywine, Glen Mary, and the Marshall under high culture.

The insects or fungous growths that are seriously injurious to the strawberry may be largely overcome by thorough and clean cultivation.

INDEX.

A

	PAGE
Abele.....	157
Actinidia, Kokwa.....	218
Advantages of home garden.....	289
mixed hedges.....	84
Alternanthera.....	242
Alyssum.....	241
Amaranthus.....	112
Ammoniacal carb. of copper.....	268
Amount of land required.....	14
Anemone Japonica.....	226
Andromeda.....	213
Aphides.....	279
A plan of ornamentation.....	2
Apple-borers.....	275, 276
Apple, Chinese double-flowering.....	155
, best varieties.....	299
, fertilizers for.....	299
, insects and fungi injurious to.....	301
, Parkman's double-flowering.....	155
, thinning the fruit.....	300
Apple-trees for shade.....	289
Aralia, Hercules'-club.....	187
, Japanese.....	188
Architecture of the house.....	18
Aquatic plants.....	249
border-plants.....	256
Arrangement of rooms	24
trees and shrubs.....	61

	PAGE
Arrangement of trees for shelter	62
screens	62
fruit-garden	291
Arbor-vitæ, American	183
, globe	183
, golden	184
, pyramidal	183
, Siberian	183
Arrow-head plant	258
Artificial system of decoration	4
Ash, American	139
, aucuba-leaved	153
, European	153
, cut-leaved	172
Asters, native	227
Astilbe, Japanese	228
Avenue-trees	135
, list of	136
Average yield of fruits	290
Avoid too close planting of trees	65
hedges	81
Azalea, pink swamp	186
, flame-colored	186
, Ghent	187
, Japanese	187
, Vaseyii	187

B

Balsams	242
Banana, Abyssinian or red-stemmed	246
Bank walls, removal	102, 103
Barberry, common	188, 221
, purple-leaved	188, 221
, dwarf Thunberg's	189
Beech, American	151
, European	152
, fern-leaved	175
, copper-leaved	174
, Rivers' purple	175
, weeping	168
Bedding-plants	242

	PAGE
Bedding-roses	207
Birch, canoe	146
, cherry or sweet.....	147
, European white.....	147
cut-leaved weeping.....	165
, gray.....	147
, purple-leaved.....	173
, Young's weeping.....	167
Black walnut	141
Bladder-fern	259
Blight, catalpa-leaf	287
, cherry leaf.....	287
, maple-leaf.....	287
, plum-leaf.....	287
, rose-leaf.....	287
, remedy for.....	287
Bloodroot	284
Blue-gum tree	247
Blue spruce, Colorado	179
Bordering walks with turf	38
Bordeaux mixture	267
Borers, apple	275, 276
, maple.....	272
, peach.....	276
Box-elder	156
Boxwood	211
Broken-stone road	112
Buildings, location of	6, 15
, relocating and improving old.....	104
Buckthorn	221
Bulletins relating to insecticides and fungicides	262, 283
Bulrush	258
Burweed	258
Bur-marigold	258
C	
Cacti	248
Caladium	245
Calendula	242
Calliopsis	242
Calycanthus	198

	PAGE
Canary-bird flower.....	242
Candytuft.....	242
Canker-worm.....	274, 275
Canna.....	243, 244
Camperdown elm.....	171
Carnation.....	280
Careful study of art of landscape gardening.....	3
Care of roads.....	115, 117
cemeteries.....	130, 134
Castor-bean.....	244
Cat-o'-nine-tail.....	258
Catalpa-blight.....	287
Catalpa.....	148
Cedar, red.....	179
, prostrate red.....	179
Cellar, drainage of.....	21
Cemeteries, care of.....	130, 134
Centaurea, dusty-miller.....	243
Character of land.....	18
Characteristics of trees.....	44
Cherry, flowering.....	149
, Japanese weeping.....	167
, care and cultivation of.....	304
Cherry-blight.....	287
Cherry-mildew.....	288
Chestnut, American.....	140, 147
, horse.....	146
China-wood.....	153
Chinese wistaria.....	217
cork-tree.....	157
Cinnamon ferns.....	258
Christmas ferns.....	258
Clematis, Japanese sweet-scented.....	216
, purple.....	215
, white.....	16
, Virginiana.....	214
Climbers, hardy.....	213, 219
Climbing roses.....	207
hardy shrubs.....	86
tender plants.....	242
Clipping lawns	40

	PAGE
<i>Closet-room, abundance of.....</i>	25
<i>Close planting, avoid.....</i>	65
<i>Cobea-vine.....</i>	242
<i>Coffee-tree, Kentucky.....</i>	153
<i>Coleus.....</i>	242
<i>Colorado blue spruce.....</i>	179
<i>Colored foliage, trees with.....</i>	172
<i>Columbine, garden.....</i>	227
, yellow.....	227
, blue.....	227
<i>Conditions for a good road.....</i>	111
<i>Construction of roads.....</i>	112, 115
farm-roads.....	109
walks and drives.....	94, 96
<i>Cost of house.....</i>	20
<i>Covering wounds on injured trees.....</i>	49
bank walls.....	102
<i>Convenience in location of house.....</i>	7
<i>Copper sulphate</i>	266
solution.....	268
<i>Cork-tree, Chinese.....</i>	157
<i>Cranberry-tree.....</i>	205
<i>Crocus.....</i>	242
<i>Cucumber-tree.....</i>	156
<i>Cultivation of fruit-trees.....</i>	294
, too much land.....	107
<i>Currant, care and cultivation.....</i>	309
<i>Curves of walks and drives.....</i>	92
<i>Cut-leaved ash.....</i>	167
beech.....	167
birch.....	165
green Japanese maple.....	172
oak.....	172
purple Japanese maple.....	171
paeonia.....	225
silver maple.....	164
sumac.....	201
variegated Japanese maple.....	172
<i>Cypress, Japanese pea-fruited.....</i>	182
thread-like.....	183
<i>Cypress-vine.....</i>	242

D

	PAGE
Daffodil.....	242
Dahlia.....	242
Daisy, English.....	228
Day-blooming water-lilies.....	253
Daphne.....	191
Deciduous trees, improving.....	98
Decoration, home and landscape-gardening	1
Decorating farm-homes.....	106
school-yards.....	126-129
Description of trees	135
Digging holes for planting trees	295
trees for planting.....	55
Deutzia, double-flowered.....	191
, slender.....	192
Direction of walks and drives	91
Distance for planting trees and shrubs.....	51
Dogwood, flowering.....	150
red	150
, red.....	190
, weeping.....	167
Drainage of cellar.....	21
surface- and sub-soil.....	22
Dutch bulbs	234

E

Elder.....	201
Elevation of land for home.....	8
house.....	17
Elm, American	136
, Camperdown.....	171
, English.....	163
, Scotch	163
, slippery.....	137
Emulsion, kerosene.....	264
Elm-beetle.....	269
Elm-scale.....	271
English violet.....	236
Escholtzia.....	242
Eulalia, Japanese.....	260

	PAGE
Evergreen trees	177
, improving and pruning.....	99, 177
, list of.....	178
shrub	209
, list of	211
Exochorda	194
Exposure of house	17
Extent of walks and drives	105

F

Farm-homes, decoration of	106
Fences and walls, removal of	103
Fertilizers for lawn	41
apples.....	299
trees and shrubs.....	61
home fruit-garden.....	299
strawberries.....	311
Ferns, hardy	258
maidenhair.....	258
cinnamon	258
Christmas.....	258
sword	258
bladder.....	259
ostrich.....	259
rattlesnake.....	259
rock.....	259
wood-rock.....	259
Filbert, purple	190
Fir, Nordmann's	179
Flowering plants, tender	87
Feverfew, golden	242
, hardy.....	284
Flag, variegated	256
Fraxinella	230
Fruit-garden, home	289
, plan of.....	291
, arrangement of.....	291
, location of.....	290
, fungous pests injurious to.....	301
, size of	290
, insect pests injurious to	301

	PAGE
Fruit-trees along roadways.....	120
Forms of hedges.....	83
Fungi and fungus-destroyers.....	261, 265
, nature of, and condition of growth.....	266
Fungicides.....	266, 267, 268
Fungi injurious to ornamentals.....	285

G

Geraniums.....	242
German ivies.....	242
iris.....	233
Gladiolus.....	240
Globe arbor-vitæ.....	194
Golden-bell.....	195
, Fortune's	196
, weeping.....	196
Golden-glow.....	232
Golden arbor-vitæ.....	184
oak	176
poplar.....	174
Grading about buildings.....	33, 35
, preliminary.....	28
Grade, how to obtain.....	29
Grouping or arrangement of trees.....	63
trees for ornamentation.....	64
, nature as a guide.....	65
Grass for lawn.....	36, 101
Grass-seed, quantity of.....	36, 101
Grape, importance of.....	305
, methods of cultivation, pruning, etc.....	306
, varieties of.....	307

H

Hardy climbers.....	86
herbaceous plants.....	223
, transplanting.....	100
, list of.....	223
ferns	258
, list of.....	258
Harris's lily.....	289

	PAGE
Hawthorn.....	154
Hawthorn-mildew.....	288
Healthfulness of home location	7
Heating the house.	24
Hedges.....	80
, forms of.....	83
of flowering shrubs.....	221
, renewing.....	98
, plants, list of.....	219
Heliotrope.....	242
Hellebore.....	264
Hemlock-spruce.....	219
Hickory, white.....	141
Holly, American.....	211
Hollyhock.....	226
Hollyhock-rust.....	286
Home, decoration of farm.....	106
, decoration of.....	5
, location of.....	6
House, location of.....	15
, architecture of.....	15
, heating of the.....	24
elevation of.....	17
exposure of.....	17
Honey-locust.....	153
Honeysuckle, Tartarian.....	197
, Japanese.....	217
Hop-tree.....	159
Horse-chestnut, common.....	146
, red-flowered.....	146
Hercules' club.....	87
Hyacinth, garden	239
, water.....	255
Hydrangia, hardy.....	196
, tender.....	248
I	
Introduction.....	V-VII
Implements for pruning	84
Importance of walks and drives	89
evergreen trees	177

	PAGE
Importance of hardy climbers.....	86
shrubs	185 .
Improperly located buildings.....	104
walks and drives.....	105
Improving old homes.....	97
deciduous trees.....	45
Improvement of roads.....	111
roadsides.....	118
evergreen trees.....	98
Increase in value from ornamentation.....	14
Indian currant.....	204
Injury caused by insects.....	261, 285
fungi.....	285
Insects, common injurious.....	269
Insecticide.....	262
, bulletins relating to.....	285, 301
Iris, Japanese.....	233
, German.....	232

J

Japanese anemone.....	226
aralia.....	188
azalea.....	187
cypress, pea-fruited.....	182
, thread-like.....	183
<ul style="list-style-type: none"><i>culalia</i> (plume-grass).....	260
hydrangia.....	196
iris.....	233
lilies.....	238
maples	148, 146, 173
quince	192, 219
roses.....	207, 220
snowball.....	206
sumac	201
tree-lilac	204
clematis, sweet-scented	216
woodbine.....	214
Jonquils.....	239
Juniper (red cedar).....	179
, prostrate.....	179

K

	PAGE
Keeping up aftergrowth of trees, etc.,.....	61
Kentucky coffee-tree	158
Kerosene emulsion.....	264
Kilmarnock willow.....	170
Kind of soil for home grounds.....	9
Knowledge of materials for ornamentation	2

L

Laburnum.....	151
Land, strongly marked features of.....	10
, amount needed for home ornamentation.....	14
, elevation and slope of	8
Landscape gardening and home ornamentation.....	1
, a careful study of the art needed.....	3
Laurel, great	212
, mountain.....	211
Lawn, clipping the.....	40
, dressing and renewing.....	40
, fertilizers for.....	41
, grading about building.....	34, 35
, time for seeding.....	37
, grass and fertilizer on old.....	101
, made of turf	39
, manuring the land for.....	33
, making surface of.....	33
, mowers for cutting the.....	40
, quantity of grass-seed for	37
, reseeding the.....	41
, sowing grass-seed on.....	38
, settling the soil.....	35
, renovating old	100
, importance of the.....	32
Lawn-grasses.....	36
Laws relating to ornamental trees	119
Leaf-blight of catalpa.....	287
cherry.....	287
maple	287
plum.....	287
sycamore.....	287

	PAGE
Leaf-spot of the rose.....	287
Lilac, common	204
, downy	205
, Japanese	204
, Josikea	205
, Persian	204
Lilac-mildew.....	288
Lilies.....	237
Lily, Batemann's	239
garden Easter.....	239
golden-banded.....	238
Harris's.....	239
lance-leaved.....	239
long-flowered.....	239
Turk's-cap	239
plaintain.....	231
hardy water.....	252
tender water.....	252
Lily-of-the-valley.....	230
Linden, American	158
, European.....	158
, white-leaved.....	158
Linden-rust.....	286
List of aquatic plants.....	250
avenue-trees.....	136
colored-leaved trees.....	172
cut-leaved trees.....	171
evergreen trees.....	177
shrubs.....	209
ornamental grasses	259
hardy climbers.....	213
herbaceous plants	223
ferns.....	258
hedge-plants	219
deciduous shrubs.....	189
round-headed trees	142
subtropical plants.....	242
tender bedding-plants.....	242
climbers.....	242
weeping trees.....	164
Location of home, convenience of.....	7

	PAGE
Location of home, healthfulness	7
, near schools, etc.	8
, on main or side street.	8
buildings.	15, 16
and extent of walks and drives.	90
of fruit-garden.	290
Locust, honey	153
, yellow.	157
Lotus, species	251

M

Magnolia, cucumber	156
, showy.	156
, Soulange's.	156
, swamp.	156
, umbrella.	155
Making surface of lawn	33
Maidenhair fern	258
Manuring the land for lawn	33
strawberries.	311
Maple, English	143
, Japanese.	144, 145, 146, 171
cut-leaved purple	171
green	172
variegated.	172
golden.	176
purple-leaved.	173
, Norway.	143
, red.	143
, Reitenbach's.	144, 173
, Schwerdler's.	144, 173
, silver.	138, 144
, sycamore	144, 173
, Tartarian.	144
, Wier's cut-leaved	165
Maple-borer	272, 273
Maple-scale	283, 284
Marigold	242
Macadam or broken-stone road	112
Mignonette	242

	PAGE
Mildew.....	287
of cherry.....	287
hawthorn.....	287
lilac.....	287
plum.....	287
rose.....	287
willow.....	287
, remedies for.....	287
Mist-plant.....	231
Mock-orange, fragrant.....	198
, golden.....	198
, large-flowered.....	199
Mountain ash, American.....	158
, European.....	159
, oak-leaved.....	159
laurel.....	211
rhododendron.....	212
Mulberry.....	156
, weeping.....	169

N

Narcissus.....	239
Nasturtium.....	242
Nature as a guide in planting.....	65
Natural <i>vs.</i> artificial systems.....	4
system explained.....	4
Nelumbium, East Indian.....	251
, white Japanese.....	252
, striped “.....	252
, Egyptian.....	252
, native.....	252
Night-blooming water-lilies.....	254
Nordmanns' fir.....	179
Norway maple.....	143
spruce.....	178
Nozzles for spraying-pumps.....	269

O

Oak, chestnut.....	163
, English.....	161

	PAGE
Oak, English, cut-leaved.....	172
, fern-leaved.....	163
, golden-leaved.....	176
, purple-leaved.....	163, 175
, pyramidal.....	163
, variegated.....	163
, pin.....	161
, red.....	139
, scarlet.....	140, 161
, swamp white.....	161
, white.....	160
Old trees, improving.....	45
Ostrich-fern.....	258, 259
Oyster-shell scale.....	280

P

Paeony, Chinese	224
, cut-leaved.....	225
, tree.....	225
Pampas-grass.....	260
Pansy.....	235
Papyrus.....	235
Paris green.....	262
used dry.....	263
with Bordeaux mixture.....	264
plaster, flour, etc.....	263
water.....	263
Parkman's flowering apple.....	155
Parks and public squares.....	124
Parrot's-feather.....	257
Pea, sweet.....	241
Peach-borer.....	276
Peach, flowering.....	155
, land best suited for growth of.....	302
, best varieties.....	303
Pear, land best suited for.....	301
, best varieties.....	302
Pepper-bush, sweet.....	190
Persian lilac.....	204
insect-powder.....	265

	PAGE
Petunia.....	242
Phlox, garden.....	224
(moss-pink).....	225
Pickerel-weed.....	258
Pin oak.....	161
Pine, Austrian.....	180
, long-leaved.....	181
, white or Weymouth.....	180
Pink, carnation.....	231
, moss.....	225
Plan of arranging ornamental trees.....	44
fruit-garden.....	289
house.....	19
strawberry-bed.....	311
Plane-tree.....	153
Planting fruit-trees for ornament.....	108
in home garden.....	297
ornamental trees	58, 59
unprofitable land with ornamental and forest trees....	107
Plum, best varieties.....	304
, cultivation of the.....	303
, flowering.....	155
leaf-blight.....	287
, purple-leaved.....	174
Plum-mildew.....	288
Plumbing.....	26
Plume-grass, Japanese common.....	260
zebrina.....	260
gracilis.....	260
variegated.....	260
Poplar, black.....	154
, Bolley's.....	154
, golden	174
, silver.....	154
, weeping.....	167
Poplar-rust.....	286
Poppy, oriental.....	233
, plume.....	229
, water.....	256
Porcupine-plant.....	256
Portulaca.....	242

	PAGE
Preparation of land for ornamental trees.....	54
shrubs.....	76
fruits.....	295
Preserve choice native trees and shrubs.....	119
Privet.....	220
Prostrate juniper.....	179
Pruning hedges.....	83
, time for.....	84
, implements for.....	84
trees for transplanting.....	56, 57
old trees.....	48
shrubs.....	79
roses.....	266
Pumps for the use of insecticides and fungicides.....	268
Purple clematis.....	215
Purple-leaved beech.....	174
birch.....	173
barberry.....	188
maples.....	144, 146
filbert.....	191
oak.....	175
Pyramidal arbor-vitæ.....	183
Pyrethrum.....	234
Pyrethrum-powder.....	234, 265

Q

Quince, common.....	304
, Japanese.....	191
, best varieties.....	304

R

Raspberry, cultivation of.....	308
, best varieties.....	309
Rattlesnake-fern.....	259
Redbud.....	149
Red cedar.....	179
dogwood.....	190
oak.....	139
spider.....	279
Red-twisted willow.....	158

	PAGE
Red-fruited elder.....	201
Reitenbach's maple	144
Removal of fences and walls.....	103
Renewing old shrubs and hedges.....	98
Renovating old cemeteries	133, 134
Renewal of old evergreens.....	99
Reseeding lawns.....	41
Retinospora picifera	182
<i>filifera</i>	183
Ribbon-grass.....	260
Rivers' purple beech.....	174
Roads, conditions necessary for good.....	111
, construction.....	112
of farm.....	109
, broken-stone or Macadam.....	112
, repairing.....	115-117
, surface of.....	113, 114
and roadside improvements.....	111
, width of.....	115
Roadsides, improvement of.....	118
, care of trees along.....	119
as a dumping-place.....	118
, fruit along.....	108
, laws relative to trees along.....	119
, ornamental shrubs along.....	121, 122
, removal of fences along.....	123
Rocks and ledges in ornamental grounds.....	10
Rocky Mountain columbine.....	227
Roses.....	206
, bedding.....	207
, climbing.....	207
, moss.....	207
, Japanese.....	207, 220
, yellow.....	209
, pruning.....	206
, varieties.....	207
, winter protection.....	207
Rose-mildew.....	288
Rose-rust.....	287
Rose-chafer.....	277
Rose-slug.....	278

	PAGE
Rose-leaf hopper.....	279
Rose-flowered water-lilies	252
Rose, insects injurious to the.....	278
Rose of Sharon.....	196
Round-headed trees, list of.....	142, 143
Rudbeckia.....	282
Rules for grouping trees	65
Rust, hollyhock.....	286
, linden.....	286
, poplar.....	286
, rose.....	286
, remedy for.....	287

S

Salvia, scarlet.....	242
Salvinia.....	256
Scale insect, oyster-shell.....	280
, San José.....	281
Scarlet oak.....	164
School-yards, decoration of.....	126-130
Schwerdler's maple.....	144
Scope of home ornamentation.....	2
Scotch elm.....	163
Screens, trees for.....	63
Scouring-rush.....	258
Seeding lawn before planting trees, etc.....	36
, time for.....	37
Seed, grass.....	36
, quantity per acre.....	37
, sowing grass.....	38
Selection of varieties of trees, etc.....	50
Settling the soil.....	36
Shadbush	146
Shed-room in outbuildings.....	25
Shelf-room in house.....	25
Shrubs, ornamental.....	185
, planting and pruning.....	76, 79
, evergreen.....	209
, preparing land for.....	76
, two methods of grouping.....	77
, list of varieties.....	185, 186

	PAGE
Shrubs, renovating old.....	98
Siberian arbor-vitæ.....	183, 219
Silvery actinidia.....	218
Silver-thorn.....	194
Silver-bell.....	196
Silver maple.....	138, 144
poplar.....	154
Size of fruit-garden.....	290
Slender deutzia.....	192
Slippery-elm	137
Slope of land for fruit-garden.....	292
Snowberry.....	203
Snowball, common.....	205
, Japanese.....	206
Snapdragon.....	242
Soil for fruit-garden.....	291
aquatics.....	250
ornamentals.....	9
Spider, red.....	279
Spiræa, Anthony Waterer.....	203
, bridal-wreath	202
, Bumald's.....	203
, golden.....	201
, Japanese.....	228
, lobed.....	203
, Thunbergs.....	203
, Van Houtt's.....	203
Spot, rose-leaf.....	287
Spruce, Colorado blue.....	178
, Norway.....	178
, white.....	178
, weeping.....	178
Spraying-pumps.....	268
St.-John's-wort, shrubby.....	197
Star cucumber.....	242
Striped nelumbium.....	252
Stone walls, removing.....	110, 128
Strawberry.....	310
, cultivation and care of.....	311
Strawberry-tree.....	194
Strawberry-bed, plan of.....	311

	PAGE
Street- and avenue-trees.....	136
, list of.....	136
Strongly marked features, preserve.....	10
Subtropical plants.....	243
Sugar-maple.....	187
Sulphate of copper.....	266
solution.....	268
Sumac, cut-leaved.....	201
, Japanese.....	201
Sunflower, hardy.....	232
Sunlight in all rooms.....	25
Surface of roads	118, 114
Surface- and sub-drainage.....	22
Swamp azalea.....	186
Sweet birch.....	147
gum.....	155
pea.....	241
pepper-bush.....	189
Sword-fern.....	258
Systems of landscape gardening, artificial.....	4
, natural.....	4
Sycamore or plane-tree.....	153
leaf-blight	287
Sycamore-maple.....	144
Syringa.....	198, 204

T

Tartarian maple.....	144
Tender bedding-plants.....	241
climbing plants.....	242
foliage and flowering plants.....	87, 88
water-lilies.....	252
Thurlow's weeping willow.....	170
Transplanting trees and shrubs.....	56, 57
hardy herbaceous plants.....	99
Trees, arrangement or grouping of.....	61
, avenue or street.....	136
, nature as a guide.....	65
for screens.....	64
for shelter.....	62
, avoid too close planting.....	65
, classification of varieties.....	135

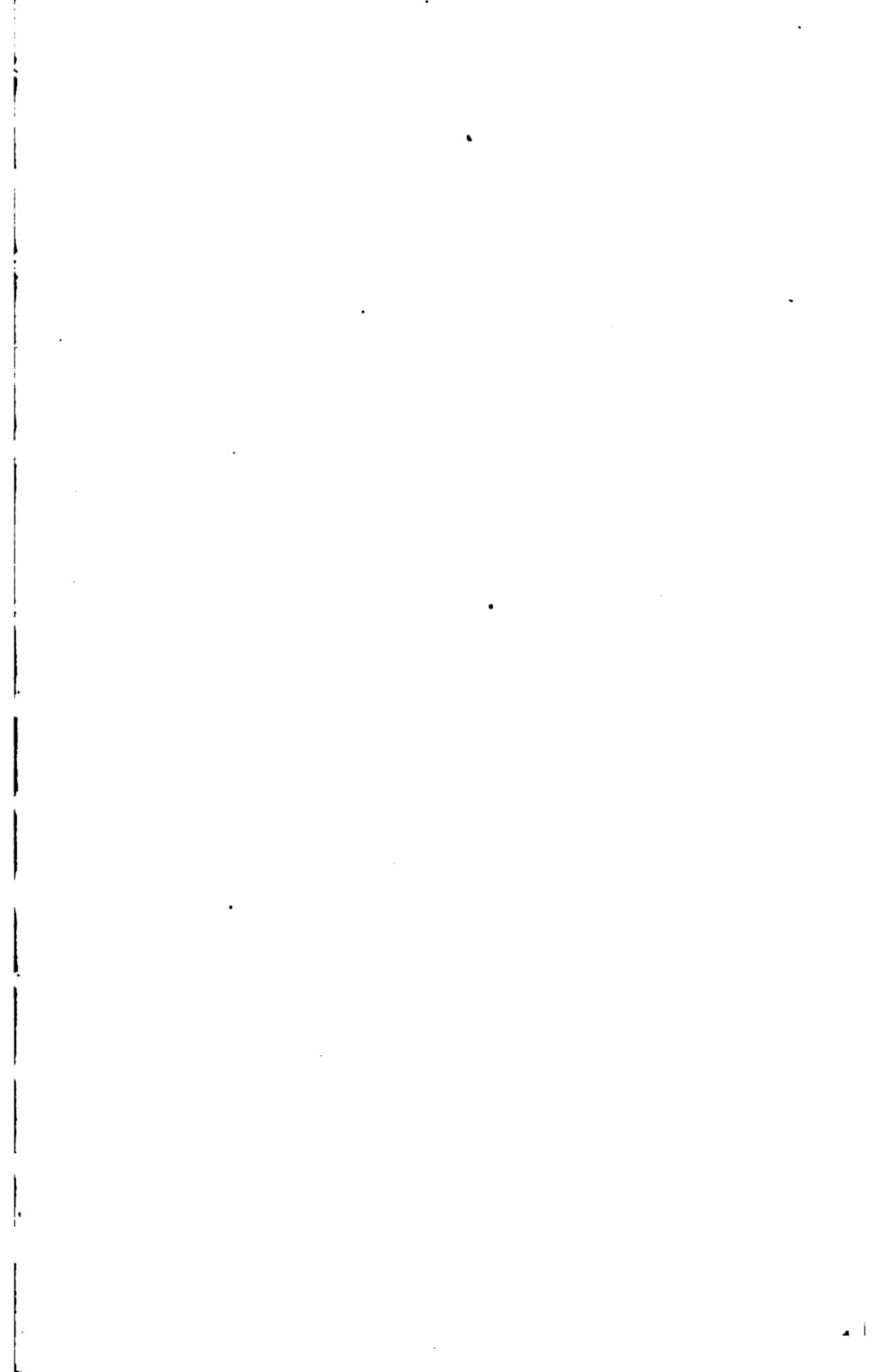
	PAGE
Trees, characteristics of	44
, cranberry	205
, covering wounds on	49
, description of	135
, digging for planting	55
, distance for planting	51
, deciduous, improving	98
, evergreen	177
, transplanting and pruning	177
, hop	159
, keeping up an aftergrowth	61
, improving old	45
, pruning old	46, 48
, plan of arrangement	44
planted along narrow roadways	52
, planting before seeding lawn	36
and care of	58, 59
, preparation of soil for planting	54
, pruning and transplanting	56, 57
, rules for grouping	65
, selection of varieties	50
, size of trees to plant	50
, time for planting	53
, watering and mulching	60
with colored foliage	172
cut foliage	171
weeping forms	164
round heads	142
, tulip	141
Trumpet-creepers	218
Tulips	239
Turk's-cap lily	239
U	
Use of cellar	21
Umbrella magnolia	155
V	
Van Houtt's spiraea	203
Variegated cut-leaved maple	171
dogwood	191
flag	256

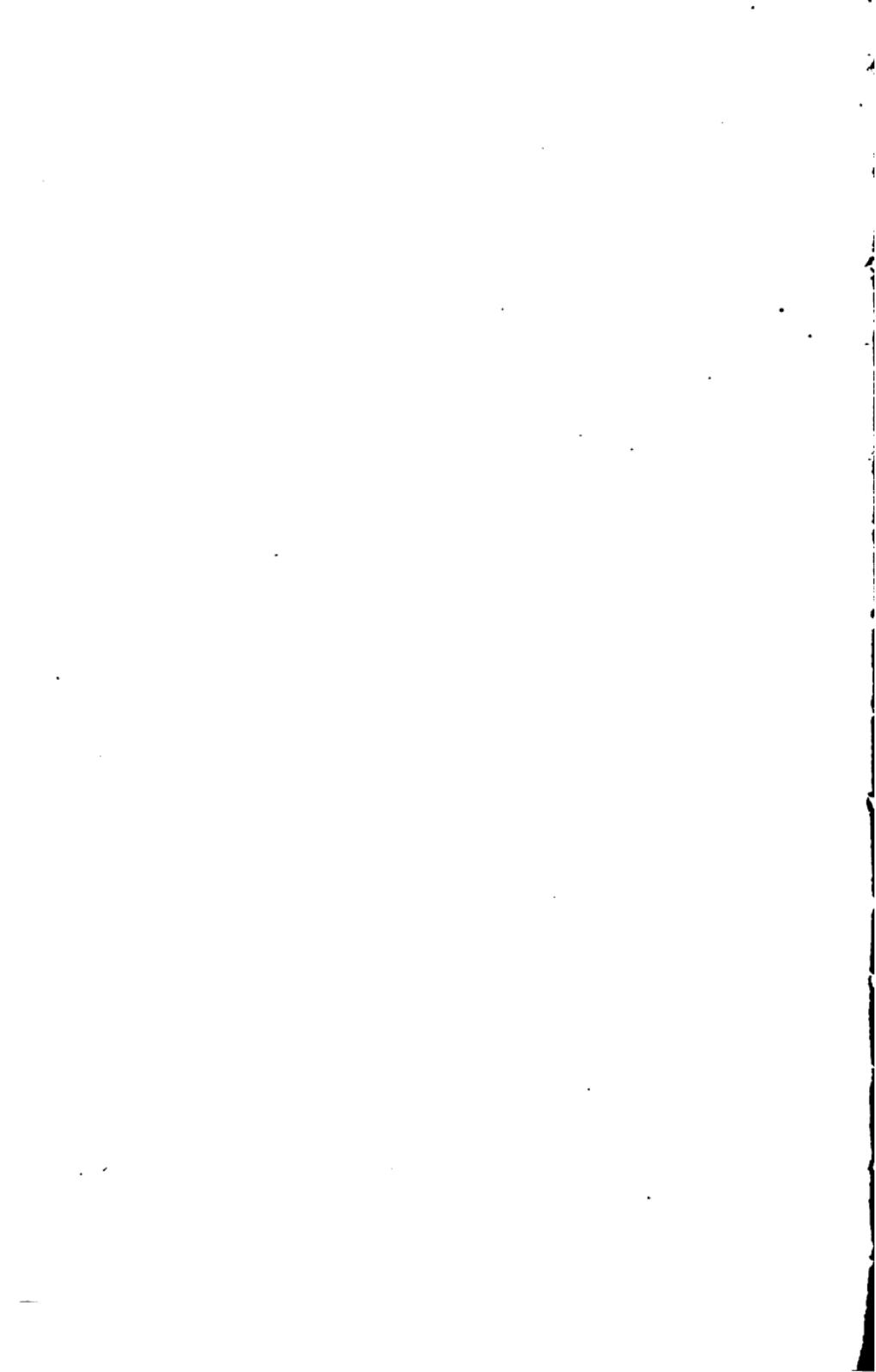
	PAGE
Variegated Japanese plume-grass.....	260
oak.....	163
weigela.....	193
Varieties of apples	300
blackberries.....	308
cherries.....	305
currants.....	310
evergreen shrubs.....	309
grapes.....	307
peaches.....	302
pears.....	301
plums.....	304
quinces.....	304
raspberries.....	309
strawberries.....	312
Vasey's azalea.....	187
Virgin's-bower.....	214

W

Wake-robin (Trillium).....	285
Walks and drives.....	89
bordered with turf.....	38
construction of.....	94, 96
direction of.....	91
how to obtain curves of.....	92
importance of.....	89
improving old.....	105
location of.....	90
width of	91
Walls and fences, removal of.....	103
Walnut, black.....	143
Water, good supply of.....	8
, underground outlet of lakelet	18
, open outlet of lakelet	18
Water-lilies, hardy.....	252
large-flowered	252
rose-flowered.....	252
, hardy yellow-flowered.....	252
, European.....	252
, tender day-blooming.....	253
night-blooming	254

	PAGE
Water-hyacinths.....	255
Water-plantain.....	258
Water-poppy.....	256
Watering trees after planting.....	60
" Well " about roots of trees.....	31
Weeping ash	167
birch, cut-leaved.....	165
, Young's.....	167
dogwood.....	167
elm, Camperdown.....	171
golden-bell.....	196
Japanese cherry.....	167
maple, Wier's cut-leaved.....	164
mulberry.....	168
poplar	167
trees, list of.....	164
willows, Babylon	169
, Kilmarnock.....	170
, Thurlow's.....	170
, purple.....	171
Whale-oil soap.....	264
White clematis.....	216
Japanese nelumbium.....	252
oak.....	160
pine.....	180
spruce.....	178
willow.....	157
wistaria.....	217
White-fringe.....	149
leaved linden.....	158
Width of road-bed.....	115
Wild rice.....	257
Winter protection of roses.....	207
evergreen shrubs.....	210
strawberries.....	311
Wistaria, Chinese.....	217
, white.....	218
Y	
Yellow roses.....	209
Young's weeping birch.....	167
Yucca or Adam's needle-and-thread plant.....	237





SHORT-TITLE CATALOGUE
OF THE
PUBLICATIONS
OF
JOHN WILEY & SONS,
NEW YORK.

LONDON: CHAPMAN & HALL, LIMITED.
ARRANGED UNDER SUBJECTS.

Descriptive circulars sent on application.

Books marked with an asterisk are sold at *net* prices only.

All books are bound in cloth unless otherwise stated.

AGRICULTURE.

CATTLE FEEDING—DAIRY PRACTICE—DISEASES OF ANIMALS—
GARDENING, ETC.

Armsby's Manual of Cattle Feeding.....	12mo,	\$1 75
Downing's Fruit and Fruit Trees.....	8vo,	5 00
Grotenfelt's The Principles of Modern Dairy Practice. (Woll.)		
	12mo,	2 00
Kemp's Landscape Gardening.....	12mo,	2 50
Lloyd's Science of Agriculture.....	8vo,	4 00
Loudon's Gardening for Ladies. (Downing.).....	12mo,	1 50
Steel's Treatise on the Diseases of the Dog.....	8vo,	3 50
" Treatise on the Diseases of the Ox.....	8vo,	6 00
Stockbridge's Rocks and Soils.....	8vo,	2 50
Woll's Handbook for Farmers and Dairymen.....	12mo,	1 50

ARCHITECTURE.

BUILDING—CARPENTRY—STAIRS—VENTILATION, ETC.

Berg's Buildings and Structures of American Railroads.....	4to,	7 50
Birkmire's American Theatres—Planning and Construction.	8vo,	3 00
" Architectural Iron and Steel.....	8vo,	3 50
" Compound Riveted Girders.....	8vo,	2 00
" Skeleton Construction in Buildings	8vo,	3 00
" Planning and Construction of High Office Buildings.		
	8vo,	3 50

Carpenter's Heating and Ventilating of Buildings.....	8vo,	\$3 00
Downing, Cottages	8vo,	2 50
" Hints to Architects.....	8vo,	2 00
Freitag's Architectural Engineering.....	8vo,	2 50
Gerhard's Sanitary House Inspection.....	16mo,	1 00
" Theatre Fires and Panics	12mo,	1 50
Hatfield's American House Carpenter.....	8vo,	5 00
Holly's Carpenter and Joiner..	18mo,	75
Kidder's Architect and Builder's Pocket-book.....	Morocco flap,	4 00
Merrill's Stones for Building and Decoration.....	8vo,	5 00
Monckton's Stair Building—Wood, Iron, and Stone.....	4to,	4 00
Wait's Engineering and Architectural Jurisprudence.....	8vo,	6 00
	Sheep,	6 50
Worcester's Small Hospitals—Establishment and Maintenance, including Atkinson's Suggestions for Hospital Archi- tecture...	12mo,	1 25
World's Columbian Exposition of 1893.....	4to,	2 50

ARMY, NAVY, Etc.

MILITARY ENGINEERING—ORDNANCE—PORT CHARGES—LAW, ETC.

Bourne's Screw Propellers.....	4to,	5 00
Bruff's Ordnance and Gunnery.....	8vo,	6 00
Bucknill's Submarine Mines and Torpedoes.....	8vo,	4 00
Chase's Screw Propellers.....	8vo,	3 00
Cooke's Naval Ordnance	8vo,	12 50
Cronkhite's Gunnery for Non-com. Officers....18mo, morocco,		2 00
Davis's Treatise on Military Law.....	8vo,	7 00
	Sheep,	7 50
" Elements of Law.....	8vo,	2 50
De Brack's Cavalry Outpost Duties. (Carr.)....18mo, morocco,		2 00
Dietz's Soldier's First Aid.....	12mo, morocco,	1 25
* Dredge's Modern French Artillery.....4to, half morocco,		15 00
" Record of the Transportation Exhibits Building, World's Columbian Exposition of 1893..4to, half morocco,		10 00
Durand's Resistance and Propulsion of Ships.....	8vo,	5 00
Dyer's Light Artillery.....	12mo,	3 00
Hoff's Naval Tactics.....	8vo,	1 50
Hunter's Port Charges.....	8vo, half morocco,	18 00

Ingalls's Ballistic Tables.....	8vo,	\$1 50
" Handbook of Problems in Direct Fire.....	8vo,	4 00
Mahan's Advanced Guard.....	18mo,	1 50
" Permanent Fortifications. (Mercur.).8vo, half morocco,		7 50
Mercur's Attack of Fortified Places.....	12mo,	2 00
" Elements of the Art of War.....	8vo,	4 00
Metcalfe's Ordnance and Gunnery.....	12mo, with Atlas,	5 00
Murray's A Manual for Courts-Martial.....	18mo, morocco,	1 50
" Infantry Drill Regulations adapted to the Springfield Rifle, Caliber .45.....	18mo, paper,	15
Phelps's Practical Marine Surveying.....	8vo,	2 50
Powell's Army Officer's Examiner.....	12mo,	4 00
Recd's Signal Service.....		50
Sharpe's Subsisting Armies.....	18mo, morocco,	1 50
Very's Navies of the World.....	8vo, half morocco,	3 50
Wheeler's Siege Operations.....	8vo,	2 00
Winthrop's Abridgment of Military Law.....	12mo,	2 50
Woodhull's Notes on Military Hygiene.....	12mo,	1 50
Young's Simple Elements of Navigation..	12mo, morocco flaps,	2 00
" " " " " " first edition.....		1 00

ASSAYING.

SMEILING—ORE DRESSING—ALLOYS, ETC.

Fletcher's Quant. Assaying with the Blowpipe..	12mo, morocco,	1 50
Furman's Practical Assaying.....	8vo,	3 00
Kunhardt's Ore Dressing.....	8vo,	1 50
* Mitchell's Practical Assaying. (Crookes.).	8vo,	10 00
O'Driscoll's Treatment of Gold Ores.....	8vo,	2 00
Ricketts and Miller's Notes on Assaying.....	8vo,	3 00
Thurston's Alloys, Brasses, and Bronzes.....	8vo,	2 50
Wilson's Cyanide Processes.....	12mo,	1 50
" The Chlorination Process.....	12mo,	1 50

ASTRONOMY.

PRACTICAL, THEORETICAL, AND DESCRIPTIVE.

Craig's Azimuth.....	4to,	3 50
Doolittle's Practical Astronomy.....	8vo,	4 00
Gore's Elements of Geodesy.....	8vo,	2 50

Hayford's Text-book of Geodetic Astronomy.....	8vo.	
Michie and Harlow's Practical Astronomy.....	8vo,	\$3 00
White's Theoretical and Descriptive Astronomy.....	12mo,	2 00

BOTANY.

GARDENING FOR LADIES, ETC.

Baldwin's Orchids of New England.....	8vo,	1 50
Loudon's Gardening for Ladies. (Downing.).....	12mo,	1 50
Thomé's Structural Botany.....	18mo,	2 25
Webermaier's General Botany. (Schneider.).....	8vo,	2 00

BRIDGES, ROOFS, Etc.

CANTILEVER—DRAW—HIGHWAY—SUSPENSION.

(See also ENGINEERING, p. 6.)

Boller's Highway Bridges.....	8vo,	2 00
* " The Thames River Bridge.....	4to, paper,	5 00
Burr's Stresses in Bridges.....	8vo,	3 50
Crehore's Mechanics of the Girder.....	8vo,	5 00
Dredge's Thames Bridges.....	7 parts, per part,	1 25
Du Bois's Stresses in Framed Structures.....	4to,	10 00
Foster's Wooden Trestle Bridges.....	4to,	5 00
Greene's Arches in Wood, etc.....	8vo,	2 50
" Bridge Trusses.....	8vo,	2 50
" Roof Trusses.....	8vo,	1 25
Howe's Treatise on Arches	8vo,	4 00
Johnson's Modern Framed Structures.....	4to,	10 00
Merriman & Jacoby's Text-book of Roofs and Bridges.		
Part I., Stresses.....	8vo,	2 50
Merriman & Jacoby's Text-book of Roofs and Bridges.		
Part II., Graphic Statics	8vo,	2 50
Merriman & Jacoby's Text-book of Roofs and Bridges.		
Part III., Bridge Design.....	8vo,	2 50
Merriman & Jacoby's Text-book of Roofs and Bridges.		
Part IV., Continuous, Draw, Cantilever, Suspension, and		
Arched Bridges.....	8vo,	2 50
* Morison's The Memphis Bridge.....	Oblong 4to,	10 00

Waddell's Iron Highway Bridges.....	8vo,	\$4 00
" De Pontibus (a Pocket-book for Bridge Engineers).		
Wood's Construction of Bridges and Roofs.....	8vo,	2 00
Wright's Designing of Draw Spans.....	8vo,	2 50

CHEMISTRY.

QUALITATIVE—QUANTITATIVE—ORGANIC—INORGANIC, ETC.

Adriance's Laboratory Calculations.....	12mo,	1 25
Allen's Tables for Iron Analysis.....	8vo,	3 00
Austen's Notes for Chemical Students.....	12mo,	1 50
Bolton's Student's Guide in Quantitative Analysis.....	8vo,	1 50
Classen's Analysis by Electrolysis. (Herrick and Boltwood.).	8vo,	3 00
Crafts's Qualitative Analysis. (Schaeffer.).....	12mo,	1 50
Drechsel's Chemical Reactions. (Merrill.).	12mo,	1 25
Fresenius's Quantitative Chemical Analysis. (Allen.).	8vo,	6 00
" Qualitative " " (Johnson.).	8vo,	3 00
" " " " (Wells) Trans. 16th.		
German Edition.....	8vo,	5 00
Fuerte's Water and Public Health.....	12mo,	1 50
Gill's Gas and Fuel Analysis.....	12mo,	1 25
Hammarsten's Physiological Chemistry. (Mandel.).	8vo,	4 00
Helm's Principles of Mathematical Chemistry. (Morgan).	12mo,	1 50
Kolbe's Inorganic Chemistry.....	12mo,	1 50
Ladd's Quantitative Chemical Analysis.....	12mo,	1 00
Landauer's Spectrum Analysis. (Tingle.).	8vo,	3 00
Mandel's Bio-chemical Laboratory.....	12mo,	1 50
Mason's Water-supply.....	8vo,	5 00
" Analysis of Potable Water. (<i>In the press.</i>)		
Miller's Chemical Physics.....	8vo,	2 00
Mixter's Elementary Text-book of Chemistry.....	12mo,	1 50
Morgan's The Theory of Solutions and its Results.....	12mo,	1 00
Nichols's Water-supply (Chemical and Sanitary).	8vo,	2 50
O'Brine's Laboratory Guide to Chemical Analysis.....	8vo,	2 00
Perkins's Qualitative Analysis.....	12mo,	1 00
Pinner's Organic Chemistry. (Austen.).	12mo,	1 50
Poole's Calorific Power of Fuels.....	8vo,	3 00
Ricketts and Russell's Notes on Inorganic Chemistry (Non-metallic).....	Oblong 8vo, morocco,	75

Ruddiman's Incompatibilities in Prescriptions.....	8vo,	\$2 00
Schimpf's Volumetric Analysis.....	12mo,	2 50
Spencer's Sugar Manufacturer's Handbook.	12mo, morocco flaps,	2 00
" Handbook for Chemists of Beet Sugar House.		
	12mo, morocco,	3 00
Stockbridge's Rocks and Soils.....	8vo,	2 50
Troilius's Chemistry of Iron.....	8vo,	2 00
Wells's Inorganic Qualitative Analysis.....	12mo,	1 50
" Laboratory Guide in Qualitative Chemical Analysis, 8vo,		1 50
Wiechmann's Chemical Lecture Notes.....	12mo,	3 00
" Sugar Analysis.....	8vo,	2 50
Wulling's Inorganic Phar. and Med. Chemistry.....	12mo,	2 00

DRAWING.

ELEMENTARY—GEOMETRICAL—TOPOGRAPHICAL.

Hill's Shades and Shadows and Perspective.....	8vo,	2 00
MacCord's Descriptive Geometry.....	8vo,	3 00
" Kinematics.....	8vo,	5 00
" Mechanical Drawing	8vo,	4 00
Mahan's Industrial Drawing. (Thompson.).....	2 vols., 8vo,	3 50
Reed's Topographical Drawing. (II. A.).....	4to,	5 00
Reid's A Course in Mechanical Drawing	8vo.	2 00
" Mechanical Drawing and Elementary Machine Design.		
	8vo.	
Smith's Topographical Drawing. (Macmillan.).....	8vo,	2 50
Warren's Descriptive Geometry.....	2 vols., 8vo,	3 50
" Drafting Instruments.....	12mo,	1 25
" Free-hand Drawing	12mo,	1 00
" Higher Linear Perspective	8vo,	3 50
" Linear Perspective.....	12mo,	1 00
" Machine Construction.....	2 vols., 8vo,	7 50
" Plane Problems.....	12mo,	1 25
" Primary Geometry.....	12mo,	.75
" Problems and Theorems.....	8vo,	2 50
" Projection Drawing.....	12mo,	1 50
" Shades and Shadows.....	8vo,	3 00
" Stereotomy—Stone Cutting.....	8vo,	2 50
Whelpley's Letter Engraving	12mo,	2 00

ELECTRICITY AND MAGNETISM.

ILLUMINATION—BATTERIES—PHYSICS.

Anthony and Brackett's Text-book of Physics (Magie). . .	8vo,	\$4 00
Barker's Deep-sea Soundings.....	8vo,	2 00
Benjamin's Voltaic Cell.....	8vo,	3 00
" History of Electricity.....	8vo	3 00
Cosmic Law of Thermal Repulsion.....	18mo,	75
Crehore and Squier's Experiments with a New Polarizing Photo-		
Chronograph.....	8vo,	3 00
* Dredge's Electric Illuminations....2 vols., 4to, half morocco,		25 00
" " " Vol. II.....	4to,	7 50
Gilbert's De magnete. (Mottelay.).....	8vo,	2 50
Holman's Precision of Measurements.....	8vo,	2 00
Michie's Wave Motion Relating to Sound and Light,.....	8vo,	4 00
Morgan's The Theory of Solutions and its Results.....	12mo,	1 00
Niaudet's Electric Batteries. (Fishback.).....	12mo,	2 50
Reagan's Steam and Electrical Locomotives.....	12mo,	2 00
Thurston's Stationary Steam Engines for Electric Lighting Pur-		
poses.....	12mo,	1 50
Tillman's Heat.....	8vo,	1 50

ENGINEERING.

CIVIL—MECHANICAL—SANITARY, ETC.

(See also BRIDGES, p. 4; HYDRAULICS, p. 8; MATERIALS OF ENGINEERING, p. 9; MECHANICS AND MACHINERY, p. 11; STEAM ENGINES AND BOILERS, p. 14.)

Baker's Masonry Construction.....	8vo,	5 00
" Surveying Instruments.....	12mo,	3 00
Black's U. S. Public Works.....	4to,	5 00
Brook's Street Railway Location.....	12mo, morocco,	1 50
Butts's Engineer's Field-book.....	12mo, morocco,	2 50
Byrne's Highway Construction.....	8vo,	7 50
" Inspection of Materials and Workmanship.	12mo, mor.	
Carpenter's Experimental Engineering	8vo,	6 00
Church's Mechanics of Engineering—Solids and Fluids....	8vo,	6 00
" Notes and Examples in Mechanics.....	8vo,	2 00
Crandall's Earthwork Tables	8vo,	1 50
" The Transition Curve.....	12mo, morocco,	1 50

* Dredge's Penn. Railroad Construction, etc.	Folio, half mor.	\$20 00
* Drinker's Tunnelling.....	4to, half morocco,	25 00
Eissler's Explosives—Nitroglycerine and Dynamite.....	8vo,	4 00
Fowler's Coffer-dam Process for Piers.....	8vo.	
Gerhard's Sanitary House Inspection.....	16mo,	1 00
Godwin's Railroad Engineer's Field-book.	12mo, pocket-bk. form,	2 50
Gore's Elements of Geodesy.....	8vo,	2 50
Howard's Transition Curve Field-book	12mo, morocco flap,	1 50
Howe's Retaining Walls (New Edition.).....	12mo,	1 25
Hudson's Excavation Tables. Vol. II.....	8vo,	1 00
Hutton's Mechanical Engineering of Power Plants.....	8vo,	5 00
Johnson's Materials of Construction.....	8vo,	6 00
" Stadia Reduction Diagram..	Sheet, 22½ × 28½ inches,	50
" Theory and Practice of Surveying.....	8vo,	4 00
Kent's Mechanical Engineer's Pocket-book.....	12mo, morocco,	5 00
Kiersted's Sewage Disposal.....	12mo,	1 25
Kirkwood's Lead Pipe for Service Pipe.....	8vo,	1 50
Mahan's Civil Engineering. (Wood.)......	8vo,	5 00
Merriman and Brook's Handbook for Surveyors.....	12mo, mor.,	2 00
Merriman's Geodetic Surveying.....	8vo,	2 00
" Retaining Walls and Masonry Dams.....	8vo,	2 00
Mosely's Mechanical Engineering. (Mahan.)......	8vo,	5 00
Nagle's Manual for Railroad Engineers.....	12mo, morocco,	3 00
Patton's Civil Engineering.....	8vo,	7 50
" Foundations.....	8vo,	5 00
Rockwell's Roads and Pavements in France.....	12mo,	1 25
Ruffner's Non-tidal Rivers.....	8vo,	1 25
Searles's Field Engineering.....	12mo, morocco flaps,	3 00
" Railroad Spiral	12mo, morocco flaps,	1 50
Siebert and Biggin's Modern Stone Cutting and Masonry...	8vo,	1 50
Smith's Cable Tramways.....	4to,	2 50
" Wire Manufacture and Uses.....	4to,	3 00
Spalding's Roads and Pavements.....	12mo,	2 00
" Hydraulic Cement.....	12mo,	2 00
Thurston's Materials of Construction	8vo,	5 00
* Trautwine's Civil Engineer's Pocket-book...12mo, mor. flaps,		5 00
* " Cross-section.....	Sheet,	25
* " Excavations and Embankments.....	8vo,	2 00

* Trautwine's Laying Out Curves.....	12mo, morocco,	\$2 50
Waddell's De Pontibus (A Pocket-book for Bridge Engineers).	12mo, morocco,	3 00
Wait's Engineering and Architectural Jurisprudence.....	8vo,	6 00
	Sheep,	6 50
" Law of Field Operation in Engineering, etc.....	8vo.	
Warren's Stereotomy—Stone Cutting.....	8vo,	2 50
Webb's Engineering Instruments.....	12mo, morocco,	1 00
Wegmann's Construction of Masonry Dams.....	4to,	5 00
Wellington's Location of Railways.....	8vo,	5 00
Wheeler's Civil Engineering.....	8vo,	4 00
Wolf's Windmill as a Prime Mover.....	8vo,	3 00

HYDRAULICS.

WATER-WHEELS—WINDMILLS—SERVICE PIPE—DRAINAGE, ETC.

(See also ENGINEERING, p. 6.)

Bazin's Experiments upon the Contraction of the Liquid Vein (Trautwine).....	8vo,	2 00
Bovey's Treatise on Hydraulics.....	8vo,	4 00
Coffin's Graphical Solution of Hydraulic Problems.....	12mo,	2 50
Ferrel's Treatise on the Winds, Cyclones, and Tornadoes...8vo,		4 00
Fuerte's Water and Public Health.....	12mo,	1 50
Ganguillet & Kutter's Flow of Water. (Hering & Trautwine.).8vo,		4 00
Hazen's Filtration of Public Water Supply.....	8vo,	2 00
Herschel's 115 Experiments	8vo,	2 00
Kiersted's Sewage Disposal.....	12mo,	1 25
Kirkwood's Lead Pipe for Service Pipe	8vo,	1 50
Mason's Water Supply.....	8vo,	5 00
Merriman's Treatise on Hydraulics.....	8vo,	4 00
Nichols's Water Supply (Chemical and Sanitary).....	8vo,	2 50
Ruffner's Improvement for Non-tidal Rivers.....	8vo,	1 25
Wegmann's Water Supply of the City of New York	4to,	10 00
Weisbach's Hydraulics. (Du Bois).	8vo,	5 00
Wilson's Irrigation Engineering.....	8vo,	4 00
" Hydraulic and Placer Mining.....	12mo,	2 00
Wolff's Windmill as a Prime Mover.....	8vo,	3 00
Wood's Theory of Turbines...	8vo,	2 50

MANUFACTURES.

ANILINE—BOILERS—EXPLOSIVES—IRON—SUGAR—WATCHES—WOOLLENS, ETC.

Allen's Tables for Iron Analysis	8vo,	3 00
Beaumont's Woollen and Worsted Manufacture.....	12mo,	1 50
Bolland's Encyclopædia of Founding Terms.....	12mo,	3 00

Bolland's The Iron Founder.....	12mo,	2 50
" " " " Supplement.....	12mo,	2 50
Booth's Clock and Watch Maker's Manual.....	12mo,	2 00
Bouvier's Handbook on Oil Painting.....	12mo,	2 00
Eissler's Explosives, Nitroglycerine and Dynamite.....	8vo,	4 00
Ford's Boiler Making for Boiler Makers.....	18mo,	1 00
Metcalf's Cost of Manufactures.....	8vo,	5 00
Metcalf's Steel—A Manual for Steel Users.....	12mo,	\$2 00
Reimann's Aniline Colors. (Crookes.).....	8vo,	2 50
* Reisig's Guide to Piece Dyeing.....	8vo,	25 00
Spencer's Sugar Manufacturer's Handbook....	12mo, mor. flap,	2 00
" Handbook for Chemists of Beet Houses.	12mo, mor. flap,	3 00
Svedelius's Handbook for Charcoal Burners.....	12mo,	1 50
The Lathe and Its Uses.....	8vo,	6 00
Thurston's Manual of Steam Boilers.....	8vo,	5 00
Walke's Lectures on Explosives.....	8vo,	4 00
West's American Foundry Practice.....	12mo,	2 50
" Moulder's Text-book	12mo,	2 50
Wiechmann's Sugar Analysis.....	8vo,	2 50
Woodbury's Fire Protection of Mills.....	8vo,	2 50

MATERIALS OF ENGINEERING.

STRENGTH—ELASTICITY—RESISTANCE, ETC.

(See also ENGINEERING, p. 6.)

Baker's Masonry Construction.....	8vo,	5 00
Beardslee and Kent's Strength of Wrought Iron	8vo,	1 50
Bovey's Strength of Materials.....	8vo,	7 50
Burr's Elasticity and Resistance of Materials.....	8vo,	5 00
Byrne's Highway Construction.....	8vo,	5 00
Carpenter's Testing Machines and Methods of Testing Materials.		
Church's Mechanics of Engineering—Solids and Fluids... .	8vo,	6 00
Du Bois's Stresses in Framed Structures.....	4to,	10 00
Hatfield's Transverse Strains.....	8vo,	5 00
Johnson's Materials of Construction.....	8vo,	6 00
Lanza's Applied Mechanics.....	8vo,	7 50
Merrill's Stones for Building and Decoration.....	8vo,	5 00
Merriman's Mechanics of Materials.....	8vo,	4 00
" Strength of Materials.....	12mo,	1 00
Patton's Treatise on Foundations.....	8vo,	5 00
Rockwell's Roads and Pavements in France.....	12mo,	1 25
Spalding's Roads and Pavements.....	12mo,	2 00
Thurston's Materials of Construction.....	8vo,	5 00

Thurston's Materials of Engineering.....	8 vols., 8vo,	\$8 00
Vol. I., Non-metallic	8vo,	2 00
Vol. II., Iron and Steel.....	8vo,	3 50
Vol. III., Alloys, Brasses, and Bronzes.....	8vo,	2 50
Weyrauch's Strength of Iron and Steel. (Du Bois.).....	8vo,	1 50
Wood's Resistance of Materials.....	8vo,	2 00

MATHEMATICS.

CALCULUS—GEOMETRY—TRIGONOMETRY, ETC.

Baker's Elliptic Functions.....	8vo,	1 50
Ballard's Pyramid Problem	8vo,	1 50
Barnard's Pyramid Problem.....	8vo,	1 50
Bass's Differential Calculus.....	12mo,	4 00
Brigg's Plane Analytical Geometry.....	12mo,	1 00
Chapman's Theory of Equations.....	12mo,	1 50
Chessin's Elements of the Theory of Functions.		
Compton's Logarithmic Computations.....	12mo,	1 50
Craig's Linear Differential Equations.....	8vo,	5 00
Davis's Introduction to the Logic of Algebra.....	8vo,	1 50
Halsted's Elements of Geometry.....	8vo,	1 75
" Synthetic Geometry.....	8vo,	1 50
Johnson's Curve Tracing.....	12mo,	1 00
" Differential Equations—Ordinary and Partial....	8vo,	3 50
" Integral Calculus.....	12mo,	1 50
" " " Unabridged.		
" Least Squares.....	12mo,	1 50
Ludlow's Logarithmic and Other Tables. (Bass.).....	8vo,	2 00
" Trigonometry with Tables. (Bass.).....	8vo,	3 00
Mahan's Descriptive Geometry (Stone Cutting).....	8vo,	1 50
Merriman and Woodward's Higher Mathematics.....	8vo,	5 00
Merriman's Method of Least Squares	8vo,	2 00
Parker's Quadrature of the Circle	8vo,	2 50
Rice and Johnson's Differential and Integral Calculus,		
2 vols. in 1, 12mo,		2 50
" Differential Calculus.....	8vo,	3 00
" Abridgment of Differential Calculus....	8vo,	1 50
Searles's Elements of Geometry.	8vo,	1 50
Totten's Metrology.....	8vo,	2 50
Warren's Descriptive Geometry.....	2 vols., 8vo,	3 50
" Drafting Instruments.....	12mo,	1 25
" Free-hand Drawing.....	12mo,	1 00
" Higher Linear Perspective.....	8vo,	3 50
" Linear Perspective.....	12mo,	1 00
" Primary Geometry.....	12mo,	75

Warren's Plane Problems.....	12mo,	\$1 25
" Problems and Theorems.....	8vo,	2 50
" Projection Drawing.....	12mo,	1 50
Wood's Co-ordinate Geometry.....	8vo,	2 00
" Trigonometry.....	12mo,	1 00
Woolf's Descriptive Geometry.....	Royal 8vo,	3 00

MECHANICS—MACHINERY.

TEXT-BOOKS AND PRACTICAL WORKS.

(See also ENGINEERING, p. 6.)

Baldwin's Steam Heating for Buildings.....	12mo,	2 50
Benjamin's Wrinkles and Recipes.....	12mo,	2 00
Carpenter's Testing Machines and Methods of Testing Materials.....	8vo.	
Chordal's Letters to Mechanics.....	12mo,	2 00
Church's Mechanics of Engineering.....	8vo,	6 00
" Notes and Examples in Mechanics.....	8vo,	2 00
Crehore's Mechanics of the Girder.....	8vo,	5 00
Cromwell's Belts and Pulleys.....	12mo,	1 50
" Toothed Gearing.....	12mo,	1 50
Compton's First Lessons in Metal Working.....	12mo,	1 50
Dana's Elementary Mechanics	12mo,	1 50
Dingey's Machinery Pattern Making.....	12mo,	2 00
Dredge's Trans. Exhibits Building, World Exposition, 4to, half morocco,		10 00
Du Bois's Mechanics. Vol. I., Kinematics	8vo,	3 50
" " Vol. II.. Statics..	8vo,	4 00
" " Vol. III., Kinetics	8vo,	3 50
Fitzgerald's Boston Machinist.....	18mo,	1 00
Flather's Dynamometers.....	12mo,	2 00
" Rope Driving.....	12mo,	2 00
Hall's Car Lubrication.....	12mo,	1 00
Holly's Saw Filing	18mo,	75
Johnson's Theoretical Mechanics. An Elementary Treatise. (In the press.)		
Jones Machine Design. Part I., Kinematics.....	8vo,	1 50
" " " Part II., Strength and Proportion of Machine Parts.		
Lanza's Applied Mechanics	8vo,	7 50
MacCord's Kinematics.....	8vo,	5 00
Merriman's Mechanics of Materials.....	8vo,	4 00
Metcalfe's Cost of Manufactures.....	8vo,	5 00
Michie's Analytical Mechanics.....	8vo,	4 00
Mosely's Mechanical Engineering. (Mahan.).....	8vo,	5 00

Richards's Compressed Air.....	12mo,	\$1 50
Robinson's Principles of Mechanism.....	8vo,	3 00
Smith's Press-working of Metals.....	8vo,	3 00
The Lathe and Its Uses.....	8vo,	6 00
Thurston's Friction and Lost Work.....	8vo,	3 00
" The Animal as a Machine	12mo,	1 00
Warren's Machine Construction.....	2 vols., 8vo,	7 50
Weisbach's Hydraulics and Hydraulic Motors. (Du Bois.)..	8vo,	5 00
" Mechanics of Engineering. Vol. III., Part I.,		
Sec. I. (Klein)....	8vo,	5 00
Weisbach's Mechanics of Engineering Vol. III., Part I.,		
Sec. II (Klein)....	8vo,	5 00
Weisbach's Steam Engines. (Du Bois.).....	8vo,	5 00
Wood's Analytical Mechanics.....	8vo,	3 00
" Elementary Mechanics.....	12mo,	1 25
" " " Supplement and Key.....		1 25

METALLURGY.

IRON—GOLD—SILVER—ALLOYS, ETC.

Allen's Tables for Iron Analysis.....	8vo,	3 00
Egleston's Gold and Mercury.....	8vo,	7 50
" Metallurgy of Silver.....	8vo,	7 50
* Kerl's Metallurgy—Copper and Iron.....	8vo,	15 00
* " " Steel, Fuel, etc.....	8vo,	15 00
Kunhardt's Ore Dressing in Europe.....	8vo,	1 50
Metcalf's Steel—A Manual for Steel Users.....	12mo,	2 00
O'Driscoll's Treatment of Gold Ores.....	8vo,	2 00
Thurston's Iron and Steel.....	8vo,	3 50
" Alloys.....	8vo,	2 50
Wilson's Cyanide Processes.....	12mo,	1 50

MINERALOGY AND MINING.

MINE ACCIDENTS—VENTILATION—ORE DRESSING, ETC.

Barringer's Minerals of Commercial Value....oblong morocco,	2 50	
Beard's Ventilation of Mines.....	12mo,	2 50
Boyd's Resources of South Western Virginia.....	8vo,	3 00
" Map of South Western Virginia.....Pocket-book form,	2 00	
Brush and Penfield's Determinative Mineralogy.....	8vo,	3 50
Chester's Catalogue of Minerals.....	8vo,	1 25
" " " ".....paper,	50	
" Dictionary of the Names of Minerals.....	8vo,	3 00
Dana's American Localities of Minerals.....	8vo,	1 00

Dana's Descriptive Mineralogy. (E. S.)	8vo, half morocco,	\$12 50
“ Mineralogy and Petrography (J.D.)	12mo,	2 00
“ Minerals and How to Study Them. (E. S.)	12mo,	1 50
“ Text-book of Mineralogy. (E. S.)	8vo,	3 50
*Drinker's Tunnelling, Explosives, Compounds, and Rock Drills.		
	4to, half morocco,	25 00
Egleston's Catalogue of Minerals and Synonyms	8vo,	2 50
Eissler's Explosives—Nitroglycerine and Dynamite	8vo,	4 00
Goodyear's Coal Mines of the Western Coast	12mo,	2 50
Hussak's Rock-forming Minerals. (Smith.)	8vo,	2 00
Ihseng's Manual of Mining	8vo,	4 00
Kuhhardt's Ore Dressing in Europe	8vo,	1 50
O'Driscoll's Treatment of Gold Ores	8vo,	2 00
Rosenbusch's Microscopical Physiography of Minerals and Rocks. (Iddings)	8vo,	5 00
Sawyer's Accidents in Mines	8vo,	7 00
Stockbridge's Rocks and Soils	8vo,	2 50
Walke's Lectures on Explosives	8vo,	4 00
Williams's Lithology	8vo,	3 00
Wilson's Mine Ventilation	16mo,	1 25
“ Hydraulic and Placer Mining	12mo.	

STEAM AND ELECTRICAL ENGINES, BOILERS, Etc.

STATIONARY—MARINE—LOCOMOTIVE—GAS ENGINES, ETC.

(See also ENGINEERING, p. 6.)

Baldwin's Steam Heating for Buildings	12mo,	2 50
Clerk's Gas Engine	12mo,	4 00
Ford's Boiler Making for Boiler Makers	18mo,	1 00
Hemenway's Indicator Practice	12mo.	2 00
Hoadley's Warm-blast Furnace	8vo,	1 50
Kneass's Practice and Theory of the Injector	8vo,	1 50
MacCord's Slide Valve	8vo,	2 00
*Maw's Marine Engines	Folio, half morocco,	18 00
Meyer's Modern Locomotive Construction	4to,	10 00
Peabody and Miller's Steam Boilers	8vo,	4 00
Peabody's Tables of Saturated Steam	8vo,	1 00
“ Thermodynamics of the Steam Engine	8vo,	5 00
“ Valve Gears for the Steam Engine	8vo,	2 50
Pray's Twenty Years with the Indicator	Royal 8vo,	2 50
Pupin and Osterberg's Thermodynamics	12mo,	1 25
Reagan's Steam and Electrical Locomotives	12mo,	2 00
Röntgen's Thermodynamics. (Du Bois.)	8vo,	5 00
Sinclair's Locomotive Running	12mo,	2 00
Thurston's Boiler Explosion	12mo,	1 50

Thurston's Engine and Boiler Trials.	.....	8vo,	\$ 5 00
" Manual of the Steam Engine. Part I., Structure and Theory.....	.....	8vo,	7 50
" Manual of the Steam Engine. Part II., Design, Construction, and Operation.....	.....	8vo,	7 50
		2 parts,	12 00
" Philosophy of the Steam Engine.....	.....	12mo,	75
" Reflection on the Motive Power of Heat. (Carnot.)		12mo.	1 50
" Stationary Steam Engines.....	.....	12mo,	1 50
" Steam-boiler Construction and Operation.....	.....	8vo,	5 00
Spangler's Valve Gears.	.....	8vo,	2 50
Trowbridge's Stationary Steam Engines	.....	4to, boards,	2 50
Weisbach's Steam Engine. (Du Bois.)	.....	8vo,	5 00
Whitham's Constructive Steam Engineering.	.....	8vo,	10 00
" Steam-engine Design.....	.....	8vo,	5 00
Wilson's Steam Boilers. (Flather.)	.....	12mo,	2 50
Wood's Thermodynamics, Heat Motors, etc.	.....	8vo,	4 00

TABLES, WEIGHTS, AND MEASURES.

FOR ACTUARIES, CHEMISTS, ENGINEERS, MECHANICS—METRIC TABLES, ETC.

Adriance's Laboratory Calculations.	.....	12mo,	1 25
Allen's Tables for Iron Analysis.	.....	8vo,	3 00
Bixby's Graphical Computing Tables.	.....	Sheet,	25
Compton's Logarithms.	.....	12mo,	1 50
Crandall's Railway and Earthwork Tables.	.....	8vo,	1 50
Egleston's Weights and Measures.	.....	18mo,	75
Fisher's Table of Cubic Yards.	.....	Cardboard,	25
Hudson's Excavation Tables. Vol. II.	.....	8vo,	1 00
Johnson's Stadia and Earthwork Tables.	.....	8vo,	1.25
Ludlow's Logarithmic and Other Tables. (Bass.)	.....	12mo,	2 00
Thurston's Conversion Tables.	.....	8vo,	1 00
Totten's Metrology.	.....	8vo,	2 50

VENTILATION.

STEAM HEATING—HOUSE INSPECTION—MINE VENTILATION.

Baldwin's Steam Heating.	.....	12mo,	2 50
Beard's Ventilation of Mines.	.....	12mo,	2 50
Carpenter's Heating and Ventilating of Buildings.	.....	8vo,	3 00
Gerhard's Sanitary House Inspection.	.....	Square 16mo,	1 00
Mott's The Air We Breathe, and Ventilation.	.....	16mo,	1 00
Reid's Ventilation of American Dwellings.	.....	12mo,	1 50
Wilson's Mine Ventilation.	.....	16mo,	1 25

MISCELLANEOUS PUBLICATIONS.

Alcott's Gems, Sentiment, Language.....	Gilt edges,	\$5 00
Bailey's The New Tale of a Tub.....	8vo,	75
Ballard's Solution of the Pyramid Problem.....	8vo,	1 50
Barnard's The Metrological System of the Great Pyramid..	8vo,	1 50
Davis's Elements of Law.....	8vo,	2 00
Emmon's Geological Guide-book of the Rocky Mountains..	8vo,	1 50
Ferrel's Treatise on the Winds.....	8vo,	4 00
Haines's Addresses Delivered before the Am. Ry. Assn...12mo.		2 50
Mott's The Fallacy of the Present Theory of Sound..Sq. 16mo,		1 00
Perkins's Cornell University	Oblong 4to,	1 50
Ricketts's History of Rensselaer Polytechnic Institute....	8vo,	3 00
Rotherham's The New Testament Critically Emphasized.		
	12mo,	1 50
" The Emphasized New Test. A new translation.	Large 8vo,	2 00
Totten's An Important Question in Metrology.....	8vo,	2 50
Whitehouse's Lake Mœris.....	Paper,	25
* Wiley's Yosemite, Alaska, and Yellowstone	4to,	3 00

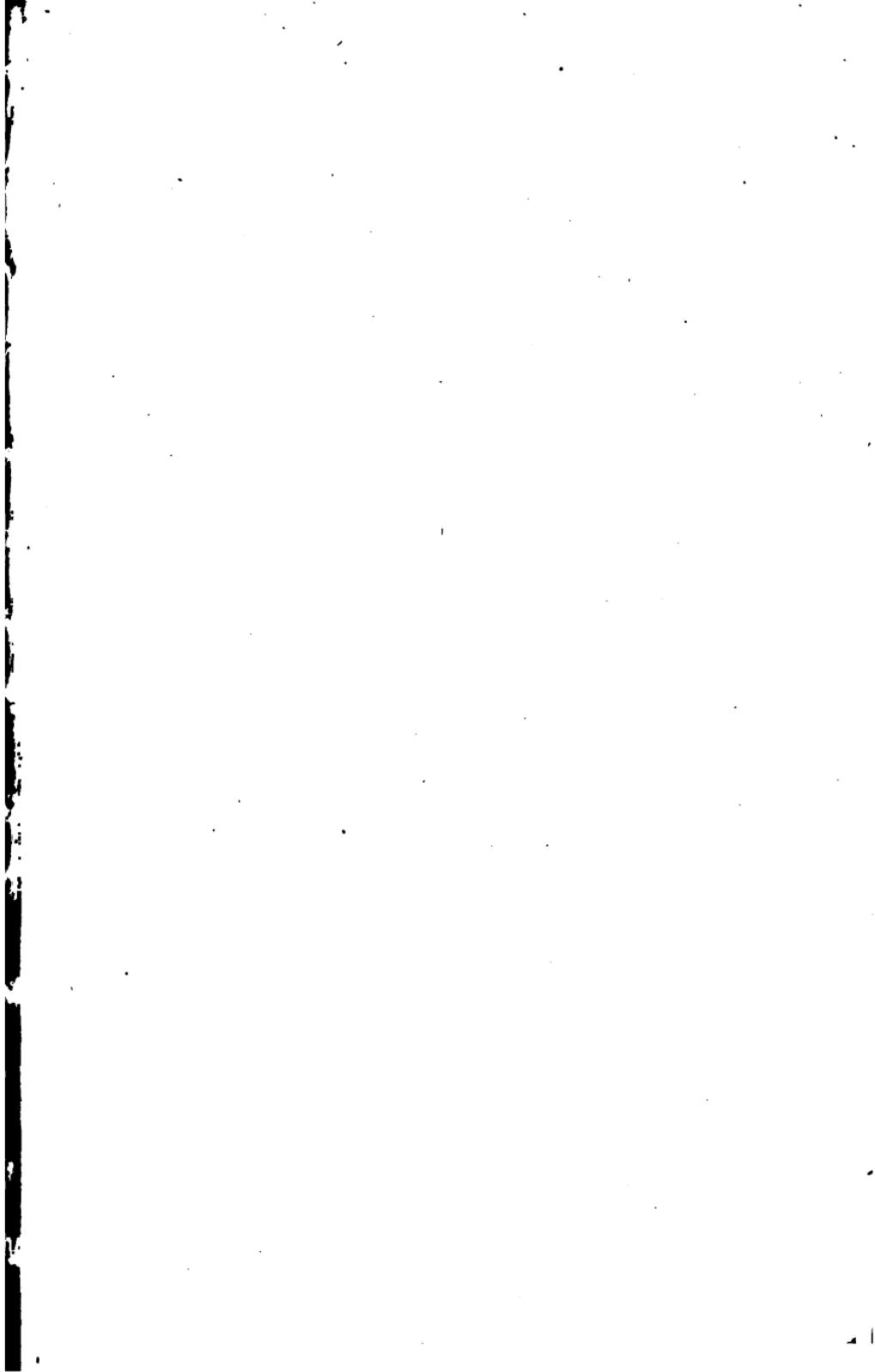
HEBREW AND CHALDEE TEXT-BOOKS.

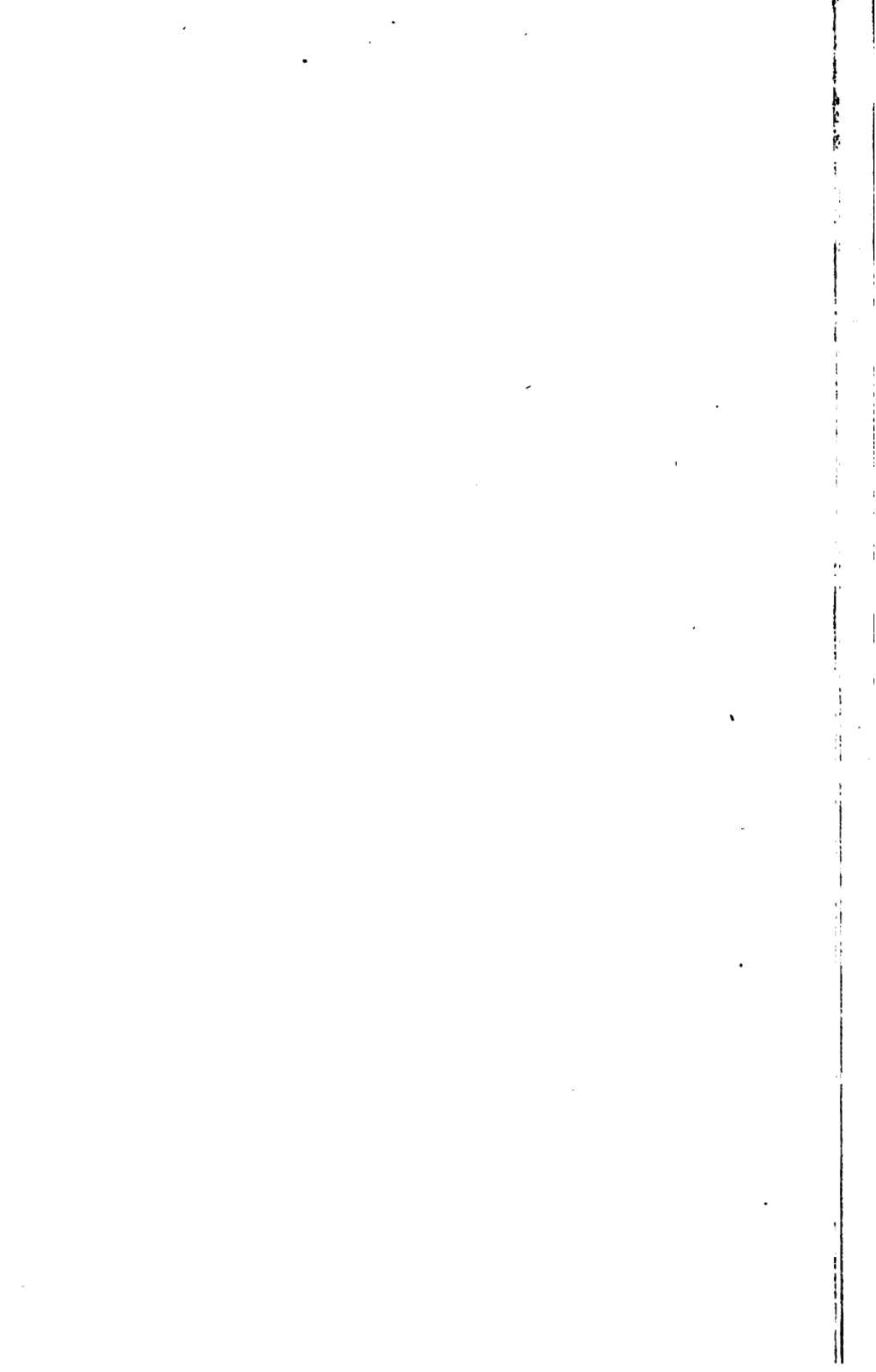
FOR SCHOOLS AND THEOLOGICAL SEMINARIES.

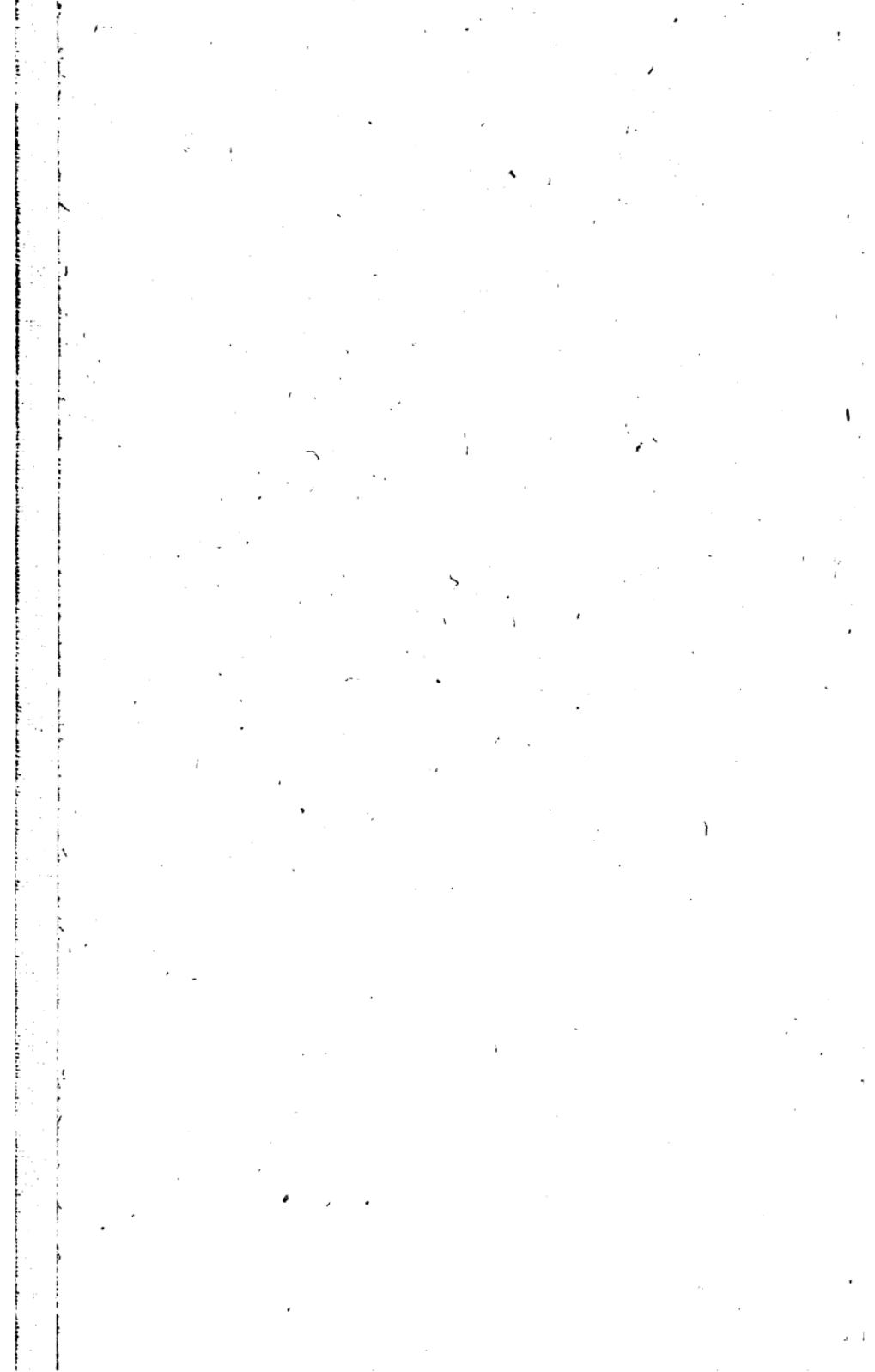
Gesenius's Hebrew and Chaldee Lexicon to Old Testament. (Tregelles.).	Small 4to, half morocco,	5 00
Green's Elementary Hebrew Grammar.....	12mo,	1 25
" Grammar of the Hebrew Language (New Edition).8vo,		3 00
" Hebrew Chrestomathy.....	8vo,	2 00
Letteris's Hebrew Bible (Massoretic Notes in English).		
	8vo, arabesque,	2 25
Luzzato's Grammar of the Biblical Chaldaic Language and the Talmud Babli Idioms.....	12mo,	1 50

MEDICAL.

Bull's Maternal Management in Health and Disease.....	12mo,	1 00
Hammarsten's Physiological Chemistry. (Mandel.).	8vo,	4 00
Mott's Composition, Digestibility, and Nutritive Value of Food.		-
	Large mounted chart,	1 25
Ruddiman's Incompatibilities in Prescriptions.....	8vo,	2 00
Steel's Treatise on the Diseases of the Ox.....	8vo,	6 00
" Treatise on the Diseases of the Dog.....	8vo,	3 50
Woodhull's Military Hygiene.....	12mo,	1 50
Worcester's Small Hospitals—Establishment and Maintenance, including Atkinson's Suggestions for Hospital Architecture.....	12mo,	1 25







**THE NEW YORK PUBLIC LIBRARY
REFERENCE DEPARTMENT**

**This book is under no circumstances to be
taken from the Building**

